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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 6 SEPTEMBER, 1927 NUMBER 3

ACUTE OTITIS IN INFANTS

ITS INFLUENCE ON CERTAIN SYSTEMIC CONDITIONS AND THE INFLUENCE OF THESE CONDITIONS ON THE METHOD OF TREATING THE COEXISTING ACUTE OTITIS *

L. W. DEAN, M.D.

IOWA CITY

This contribution is based on a series of observations made on infants suffering from acute otitis accompanied by marked systemic disturbances. All the patients have been studied in connection with the pediatrician. The observations made are my own judgments based on a personal study of the conditions. None of the conclusions are necessarily final, but they are interesting and important, and perhaps may contribute a little to the management of this difficult condition.

LITERATURE

In 1894, Hartmann [1] mentioned intestinal disturbances in otitis media in infants. Ponfick and Hartman noted that intestinal disturbances improved after paracentesis. They thought that intestinal disturbances were due to streptococci growing in the middle ear. In 1897, Ponfick [2] discussed the relationship between acute otitis and intestinal disturbances in infants. In thirty-eight cases of chronic enteritis, thirty-three patients had involvement of the middle ear. In 1896, Simmons [3] spoke of finding lesions of the kidney in poorly nourished infants who had acute otitis. He thought that acute otitis was the etiologic factor in patients with edema and with albumin in the urine.

Kossel [4] reported that in 105 cases of otitis found at autopsy, the ear drum was perforated in only three. He thought that the lesion of the middle ear was due to disturbance of the intestinal function, and remarked that in each case the nurse or mother said that the child did not show symptoms of any disturbance. There were few or no symptoms from the intestinal tract. The stools were normal, and yet from day to day the child lost weight, and unaccountable death supervened.

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* Read at the Sixteenth Annual Meeting of the American Otological Society, New York, May 31, 1927.

1. Hartmann: Deutsche med. Wchnschr. 1894.
2. Ponfick: Berl. klin. Wchnschr. 1897.
3. Simmons: Deutsche Arch. f. klin. med. **19,** 1896.
4. Kossel, H.: Charite-Annalen, 1893, p. 498.

Kossel made the observation that in this class of cases, with few exceptions, the middle ear was found filled with pus. Hermann Preysing,[5] Ponfick[6] and Heermann[7] have contributed three large, almost monographic, references to this subject. All three emphasized one particular condition. Ninety per cent of infants who die from any cause show changes and bacterial infection of the middle ear and in many instances, of the mastoid. They differentiated between the embryonal tissue and its detritus in the middle ear and the real pus found after the third month. They referred to Trölsch[8] and Zaufal,[9] and then mentioned Kutscharianz,[10] who described 300 autopsies in which there were only 70 normal ears.

As a result of these observations, it was customary in Germany, about 1900, to perform a myringotomy at the slightest provocation.

Gomprez[11] spoke of the refusal of food by infants with infections of the middle ear. He thought that this was due to the presence of toxins in the blood resulting from infections in the middle ear.

In 1910, Whiting[12] mentioned the fact that little danger is to be apprehended from operation on the mastoid in infants when performed by competent men. He also said that high fever in itself was not sufficient to justify operation; that other causes for the fever must be investigated. He made no reference to refusal of food, diarrhea, loss of weight, emesis and malnutrition.

In 1910, Gruening[13] expressed the opinion that the pediatrician did not have his patients' ears examined as frequently as he should. He did not mention any relationship between infection of the ear in infants and systemic conditions.

Duel,[14] in discussing these papers, called attention to an important point: In infants with acute otitis, the mortality has been greatest in patients known as "feeding cases," in whom assimilation is bad and vitality low. He also made a most important observation: "The otologist who operates on an infant under two years of age needs the pediatrist to help him in the subsequent care of the case just as much or more than the pediatrist needs him to do the operating." The idea that

5. Preysing, Hermann.: Otitis media der Saüglinge, J. F. Bermann, 1904.

6. Ponfick, E.: Ueber die allgemein pathologischen Bezeihungen der Mittelohr Erkrankungen im frühen Kindesalter, Berl. klin. Wchnschr., 1897, p. 380.

7. Heermann, G.: Ueber Otitis media in frühen Kindesalter (Otitis concomitans), Sammlung zwangl. Abh. u. Geb. d Nasen, Ohren, Mund und Halskrantheiten, Karl Marhold, 1898.

8. Trölsch: Lehrbuch der Ohrenheilkunde, 1875.

9. Zaufal: 1870.

10. Kutscharianz: Arch. f. Ohrenh. **10**:119, 1876.

11. Gomprez, B.: Pathologie and Therapy Mittelohrentzündungen Säuglinsalter, 1906.

12. Whiting, Fred: Arch. Pediat. **27**:735, 1910.

13. Gruening: Pediatrics and Otiatrics, Arch. Pediat. **27**:732, 1910.

14. Duel, A. B.: Arch. Pediat. **27**:743, 1910.

I am adding to Duel's observation is that the otologists need the pediatrician's help in determining when to operate.

I think the conception of otitis in early childhood, up to 1910, might be summed up in the following five observations made by Heermann [7]:

1. Inflammation of the middle ear develops in young children in connection with severe exhausting disease states as an "otitis concomitans."

2. This otitis forms a *complication* of the initial disease, but it produces none of the disease symptoms, and so far as has yet been shown, it exerts no influence on the course of the disease processes.

The causative bacteria are found in the normal canal and external meatus. The patient's weakened organism furnishes the condition which permits the bacteria to become active.

4. In certain cases this "otitis concomitans" may develop into a severe complication, and it may then be difficult or impossible to distinguish it etiologically from a genuine otitis media.

5. An otitis concomitans, as such, calls for no therapeutic measures. Should its symptoms become acute, it is sufficient to treat it as a genuine otitis media.

Renaud,[15] in 1921, concluded that in spite of the frequency of double suppuration of the mastoid found at autopsies on infants dying from all causes, the fact that complete recovery has been brought about in advanced stages of illness by simple otologic intervention indicates that the suppuration of the ears is of the greatest importance in the study of pathologic conditions in the infant. He considered of little importance the question as to whether the otitis is a secondary or primary condition. The main fact is that the otitis of the infant is far from being a negligible condition. Renaud was of the opinion that infants with the gastro-intestinal syndrome should not be considered as suffering from dyspepsia or some inherited condition; they should be considered as being cachetic because they are infected, and they should be treated first for the infection. His second conclusion was that the ears of infants should be examined systematically and as a routine procedure and that such an examination is far more important than auscultation of the chest. It is especially important to examine the ears because spontaneous drainage does not always occur. He found otitis in eight of ten cachetic infants. If he did not find otitis, the prognosis was favorable; if otitis was discovered, the prognosis was grave and more guarded. The question of alimentation is secondary to the treatment of the ears. As a result of the application of his principles, infant mortality has decreased.

In 1922, Schwartz [16] asserted that 90 per cent of the gastro-intestinal disturbances in infants primarily have nothing to do with the intestines;

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15. Renaud, Maurice: Otitis and Suppuration of the Petrous Bone in Infants; Their Extreme Frequency; Their Importance in Infantile Diarrheas and Their Rôle in the Genesis of Athrepsia, Bull. et mém. Soc. méd. d. hôp. de Paris **45**:1326, 1921.

16. Schwartz, Hermann.: Relation of Diarrhea in Children to Otitis Media Purulenta, M. Rec. **101**:86, 1922.

that if the child has otitis media, diarrhea and mucous in the stools or vomits, the rise in temperature is not caused by the intestinal disturbance, but by the otologic condition. Another form of gastro-intestinal disturbance due to otitis is persistent vomiting; this is a parenteral condition secondary to otitis media or any other infection, and is no different when secondary to otitis than when secondary to other infections. The gastro-intestinal disturbance is probably due to bacterial toxins. A proper diagnosis can be made only after examination of the ear.

In 1922, René Arbeltier [17] presented the following conclusions:

> Otitis exists in seventy per cent of the seriously sick infants; discharging ears in only seven or eight per cent. The otitis is associated with an inflammation of the nasopharynx.

He made the observation that when the acute otitis has apparently healed, there is a possibility of a focus of infection being left behind.

In cachexia, the otitis is in reality often a hidden cause of malnutrition. This cannot be questioned when the infant recovers its health as soon as the ears are healed.

In 1924, Byfield [18] spoke of saving the lives of young infants with gastro-enteritis, dehydration and acidosis by drainage of the mastoid antrum.

In 1924, Lee Mee and Bouchet [19] referred to otitis in infants as latent only in the sense that there are not any local subjective symptoms. Marked objective changes often occur in the drum head. For instance, it is dull, moist, dirty gray, and later yellowish gray or brown; the posterior superior quadrant is reddened; the light reflex is absent, and sometimes bulging is present. The only symptoms of otitis are pyrexia and a poor general condition.

In 1924, Southby [20] mentioned symptomless otitis media.

In 1925, Emerson [21] expressed the opinion that acute otitis media is the most frequently overlooked condition of infancy and early childhood.

In 1925, Floyd [22] reported that the symptoms of gastro-intestinal disturbance due to mastoiditis are lethargy, frequent and loose stools and dehydration, with great and rapid loss in weight in spite of treatment.

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17. Arbeltier, René: Sur la fréquence et la gravité de l'otite du hourisson, Paris Thesis, 1922.
18. Byfield, A. H.: Abstracts of Pediatrics, vol. 3.
19. Le Mee and Bouchet.: Latent Otitis in the Child, J. méd. franc., October, 1924.
20. Southby: Symptomless Otitis Media in Infancy and Childhood, M. J. Australia **1**:410 (April) 1924.
21. Emerson: Acute Otitis Media in Infancy and Childhood, Boston M. & S. J. **173**:616, 1925.
22. Floyd, M. L.: Masked Mastoiditis Simulating Alimentary Intoxication, Arch. Otolaryngol. **1**:411 (April) 1925.

Marriott [23] called attention to the relationship between streptococcic infections of the mastoid and severe nutritional disturbances characterized by severe watery diarrhea, prostration, rapid loss of weight, failure to retain fluid even when given in large amounts, a gray color of the skin and acidosis. In a large proportion of these cases, there was almost immediate relief following operation on the mastoid. In certain instances, it is advisable to perform an exploratory operation on the mastoid even though symptoms of otitis media are absent.

Jeans [24] mentioned the fact that the symptoms in this condition are connected with the gastro-intestinal tract and not with the ear. All his cases occurred in children under 16 months of age. He observed similar conditions in a child 2 years of age, but they were more chronic. He makes a most important observation when he states that last winter a child with exactly the same symptoms, with minor differences, had acute sinus disease without mastoiditis. Drainage of the sinuses cleared up the local and the systemic condition just as quick.

Alden and Lyman [25] fully discussed the relationship between acute otitis media and cholera infantum in infants.

Dean [26] described his early experience with otitis and toxemia in infants. He expressed the opinion at that time that it was not necessary to perform a mastoidectomy on all infants with acute otitis and gastro-intestinal manifestations.

Jeans [27] reported syncopal death in several infants suffering from acute otitis media. He also spoke of moderate diarrhea and excoriation of the buttocks which resist all dietary readjustment when the cause seems to be chronic otitis.

Alden [28] suggested that in infants with otitis media and the cholera infantum syndrome the hemolytic streptococcus had been invariably found in the ears.

Rogers [29] reported that in his experience early puncture of the drum head was usually sufficient to control the syndrom of cholera infantum.

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23. Marriott, McKim: Some Further Observations Concerning the Nature of Nutritional Disturbances, Am. J. Dis. Child. **30**:577 (Oct.) 1925.

24. Jeans, P. C.: Discussion of paper by Dr. Marriott: Further Observations Concerning the Nature of Nutritional Disturbances, Am. J. Dis. Child. **30**:577 (Oct.) 1925.

25. Alden and Lyman: Tr. Am. Laryngol. Rhinol. & Otol. Soc. 1925.

26. Dean, L. W.: Tr. Am. Laryngol. Rhinol. & Otol. Soc., 1925, p. 74.

27. Jeans, P. C.: Mastoiditis with Unusual Manifestations, read before a meeting of the Central States Pediatric Society, Oct. 22, 1926.

28. Alden, A. M.: New Procedure in Treatment of Chronic Maxillary Sinus Suppuration in Children, Arch. Otolaryngol. **4**:521, 1926.

29. Rogers: Systemic Manifestations of Otitis Media and Mastoid Involvement in Very Early Infancy, Lancet **46**:34, 1926.

Huenekens [30] is of the opinion that the pediatrician has more knowledge of the likelihood of the presence of a focus of infection than the otologist, and that he should decide when the operation is necessary.

Jeans [31] mentioned that the clinical picture described in textbooks under cholera infantum, or alimentary intoxication, may be produced by either mastoiditis or sinusitis, and that the symptoms may be caused to disappear promptly by free drainage from the site of the infection. Cases of cholera infantum in which infection of the upper respiratory tract was not present have not come to the author's attention. It is essential for the successful working out of these diagnostic problems that the pediatrician and the otorhinologist work in the closest cooperation and with entire confidence in each other.

SYSTEMIC CONDITIONS CAUSED BY OTITIS

Refusal of Food—Acute otitis in infants may cause refusal of food. O., aged 6 weeks, was in the hospital for an operation on the anterior cleft and hairlip. The pediatrician reported that the infant was taking his feedings as he should and was in good condition for the operation. Forty-eight hours later, before the operation was performed acute otitis developed in the right ear. The baby refused food and became difficult to feed.

This is a common observation in both the pediatric and otolaryngologic services of the State University of Iowa Hospital.

In the case of T., aged 1 year, the pediatric diagnosis was refusal of food. The pediatrician had informed the parents that the pathologic condition was otolaryngologic. For twenty-four hours previous to admission to the hospital, practically no food had been taken. The diagnosis was acute otitis, acute tonsillitis and acute infection of the paranasal sinus. A myringotomy was performed on the right ear, and conservative treatment of the nose and throat was instituted. The infant made excellent progress. On the eighteenth day, a mastoidectomy was performed because of edema over the tip of the right mastoid. There was no pediatric indication for operation. At the time of the operation the posterior wall on the left of the canal was markedly bulging. If an infant does not have a systemic disturbance, I do not consider bulging of the posterior superior wall of the canal an indication for operation. In ten days, both ears apparently were well. The infant was taking its feedings normally and was gaining in weight. A week after the baby was discharged, it suddenly refused all food, and the pediatrician dismissed the subject by saying the cause must be in the head. The drum head of the left ear was a little discolored and slightly bulging. A myringotomy was performed, and in twenty-four hours the baby was taking its feedings normally.

The reason for performing a myringotomy was refusal of food; there was no otologic indication for the operation. Acute otitis does cause infants to refuse food; when mild acute otitis is accompanied by refusal of food, some form of drainage is indicated.

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30. Huenekens, E. J., in discussion on Jeans: The Diagnosis and Impotance of Sinusitis and Mastoiditis, abstr. in Am. J. Dis. Child. **33**:358 (Feb.) 1927.

31. Jeans, P. C.: The Diagnosis and Importance of Sinusitis and Mastoiditis, Am. J. Dis. Child. **33**:357 (Feb.) 1927.

Malnutrition and Loss of Weight—Otitis may cause malnutrition with loss in weight in infants and young children.

N. B., aged 4 months, was presented to the pediatrician who made a diagnosis of malnutrition. By a change in diet, the weight was increased 2 pounds (0.9 Kg.) in three weeks.

This is what Dr. Jeans considers a typical feeding case.

On the same day, C. B., also aged 4 months, entered the pediatric service. To the otolaryngologist, this baby would not appear any different from N. B. A change in the diet, however, would not produce the desired result. Dr. Jeans considered the malnutrition with loss in weight to be due to an infection about the upper respiratory tract. The otolaryngologic diagnosis was bilateral acute otitis, chronic infection of faucial and pharyngeal tonsils and chronic disease of the paranasal sinus. There was a rapid increase in weight following myringotomy. Because of the persistent abundant purulent discharge from each ear, a bilateral mastoidectomy was performed, and later the patient was treated for the paranasal sinus disease. This resulted in a constant satisfactory increase in weight extending over a period of two and one-half months. Following treatment for the paranasal sinus disease, the weight of the infant increased noticeably.

This was not a feeding case, but malnutrition and loss of weight due to infection, and the patient's condition was improved by the removal of the infection.

A pediatrician diagnosed the condition of Dorothy H., aged 14 months, as malnutrition due to infection about the nose and ear. The otolaryngologist's diagnosis was bilateral acute otitis, much more marked in the right than in the left ear, and chronic infection of the paranasal sinuses. As a result of myringotomy of the right ear and the treatment for the infection of the nasal sinus, there was a satisfactory increase in weight. As the infant was doing so well, the left drum head was not incised. Almost two months later, the faucial and pharyngeal tonsils were removed. Throughout the treatment, the progress was satisfactory; the weight increased, and the fever disappeared. It is not necessary to perform a mastoidectomy when there is a serious systemic condition secondary to the acute otitis; frequently, myringotomy is sufficient.

These cases show the influence of acute otitis on the nutrition and the weight of the infant. I feel that poor nutrition and the loss of weight is an indication for drainage if acute otitis is present. Mastoidectomy is not necessarily indicated.

Cholera Infantum.—The most important complication of acute otitis in infancy is the cholera infantum syndrome, a condition characterized by malnutrition, diarrhea, anhydremia, loss of weight, fever and, in many instances, severe prostration.

J. O., aged 2 months, whose case was a feeding case, was doing well. The parents had been notified that the child was ready to go home. On the day that the parents arrived, the baby had a marked diarrhea, and a distinct bulging and reddening of the posterior superior wall of each canal was noted. Anthrotomy was performed. The diarrhea decreased, and the weight increased. The temperature curve was fairly flat. On the seventh day, there was a sudden loss in weight, a temperature of 103.5 F., diarrhea and excoriation of the buttocks. Mastoidectomy was strongly advised, not because of the otologic symptoms, but because of the systemic disturbance. The left ear especially was doing well. It

was almost dry, and the drum head was rapidly becoming pale. A number of times in my experience when the ears were apparently well and otologically the infants appeared to be progressing, mastoidectomy was performed because of a systemic disturbance, and an abscess was found in the mastoid. Consequently, a bilateral mastoidectomy was performed in this case. A large abscess with pus and granulations was found in the left mastoid. The infant improved in every way; following mastoidectomy the weight increased, the temperature curve was flattened, and the diarrhea disappeared.

Mastoiditis.—It is easily conceivable that following acute otitis the improvement in the ears may apparently be satisfactory, but a focus may remain in the mastoid and be the cause of the systemic disturbance; consequently, if there has recently been a discharge from the ears of infants with the syndrome of cholera infantum, I should consider the mastoid as a possible source of toxemia.

In examining an infant I have never missed the diagnosis of acute otitis when it was present. If the drum head and the wall of the canal are carefully studied, a diagnosis of acute otitis can always be made, if it exists.

A pediatrician had made a diagnosis of anhydremia in the case of M., aged 2 years. There was a sudden marked loss in weight and a temperature of 104 F. Acute otitis was diagnosed. Following drainage of the mastoid, the temperature curve became almost flat. There was a sudden increase in weight, and the infant was soon apparently well.

C. S., aged 1 year, according to the pediatrician, presented a typical picture of cholera infantum. Acute otitis was found, and a mastoidectomy was performed on each side. I was not present at the time of the operation. After a few days, the baby died. At autopsy one overlooked mastoid cell filled with pus was found.

This case and others indicate that anthrotomy or simple drainage of the mastoid antrum is not always sufficient; a complete mastoidectomy must be performed. Pneumatization of the mastoid is frequently well marked in infants, and the zygomatic cells are especially likely to be well developed. A thorough mastoidectomy should be performed on an infant in four minutes, and a bilateral mastoidectomy and the removal of adenoids, in eleven minutes.

Syncopal Attacks.—Otitis media in infants apparently is associated with, and perhaps may be, the cause of syncopal attacks which may result in death.

J., aged 3½ months, was in the pediatric service and apparently was making favorable progress. He was gaining rapidly in weight. Two days before an attack, he had a little fever, his temperature being 100.6 F. rectally. The infant was seen at 9 a. m., and his condition was thought to be satisfactory. At 10:30 a. m., it was noticed that he was pale and anemic looking; before noon, he was dead. The only positive condition found at autopsy was a bilateral otitis with mastoiditis.

S., aged 3 months, in the pediatric service, made a satisfactory gain in weight. He did not have fever, and the stools were normal. At 4 o'clock one morning he was found dead. The only positive condition found at autopsy was a bilateral mastoiditis. Neither of these infants was seen by the otologist.

K., aged 1 month, was rapidly increasing in weight and the fever was disappearing. In this instance, it was known that the baby had otitis, but the child was thought to be recovering. He also died suddenly. In the pediatric service, there was another infant, aged 20 months, who had bronchopneumonia. During convalescence, otitis was diagnosed. There was only a slight elevation of temperature, and the infant was apparently no worse because of the complication. I had seen the infant and had performed a myringotomy, and an uneventful course seemed probable. Suddenly he was found in a state of collapse in which death seemed imminent. Dr. Jeans suggested that the mastoids be opened as soon as possible. During the interim between the first attack and the operation, which was performed in a few hours, he had two more similar attacks. Between attacks he was able to walk around on his bed. Following mastoidectomy, the infant made an uneventful recovery.

Dr. Jeans, while not positive, believes that otitis is the probable explanation for these syncopal attacks. In the cases of J. and S., there were no symptoms that suggested to the pediatricians the need of an otolaryngologic examination.

Eunice P., aged 2 years and 7 months, was in the pediatric service with a diagnosis of leukemia. She had a mild otitis for which myringotomy had been performed. The child had an attack of rapid respiration, became rigid and died in sudden shock. Dr. Jeans wrote me a note, in which he said: On her first night in the hospital, she had a similar attack but recovered. For this reason an otologic examination was requested and acute otitis was found. This makes the fourteenth case of which we have record in which syncopal attacks occurred. Infection of the ear has been present in all. In eight of them, death occurred during the first attack.

These observations convince me that otitis in infants may influence refusal of food, malnutrition with loss of weight, diarrhea, excoriation of the buttocks, anhydremia, the syndrome of cholera infantum and perhaps syncopol attacks. Further, I have been more influenced in my treatment in most cases of acute otitis in infants by the absence or presence of one or more of these conditions than by the otologic symptoms.

COOPERATION OF OTOLARYNGOLOGIST AND PEDIATRICIAN

The majority of infants with acute otitis whom I see have marked otologic symptoms. The drum head usually presents a change in color; the short process is apparently shorter than usual; the light reflex is distorted, and there is a slight bulging of the posterior superior quadrant or of the posterior wall of the canal. In every one of my cases, the infants were studied by the pediatrician and me together. Usually one of us was on one side of the infant and the other on the other side, and we took into consideration the condition of the ear and the pediatric symptoms. When the pediatrician says that the child is doing well, unless there is a distinct otologic indication for myringotomy or mastoidectomy, I do neither, even if bulging of the posterior superior wall is marked. If, on the other hand, the pediatrician reports that one of the foregoing complications is present in a marked degree and in his judgment some

treatment for the ears should be given, myringotomy or mastoidectomy is performed, even if otologically the otitis is mild. I always perform a myringotomy and wait for a report from the pediatrician before performing a mastoidectomy, unless the pediatrician says the case is so critical that the best drainage of all infected cavities must be secured immediately. If I perform a myringotomy, and at the end of forty-eight hours the infant is no better, the decision as to whether or not drainage of the mastoid should be performed is decided by the otologist and pediatrician in conference.

I am working with pediatricians who have a definite conception of the functions of otolaryngologists in cases in which the systemic conditions I have enumerated are present. Often the pediatrician is positive that most of the treatment required is in the otolaryngologic field, and in his private practice he tells the parents so; thus he throws responsibility on the otolaryngologist that he cannot avoid. I would be careful in my examination before I would say that there was not infection about the ears, nose or throat in sick infants, if the pediatrician said that such a condition was probably present and responsible for the illness. Many of the infants who are not in a critical condition and who do not need active pediatric service are transferred to the care of otologists, and the treatment becomes almost wholly otolaryngologic.

An infant may have acute otitis and not have any marked systemic disturbance that would influence the otologic treatment. If infants with acute otitis are placed under the supervision of the pediatrician, one of the symptoms mentioned will appear, although perhaps in a mild degree. G., aged 9 days, developed an acute otitis of the left ear. A myringotomy was performed because of fever. A few days later, there was a distinct acute otitis of the right ear. The infant was constantly under the supervision of the pediatrician; he did not lose weight at any time, he did not refuse food and dehydration or diarrhea was not present. Consequently, in spite of the fact that otologically the right ear was more seriously infected than in many cases in which mastoidectomy was performed because of a marked systemic disturbance, and that the acute otitis in the left ear was much more marked than in many cases in which myringotomy was done because of the absence of systemic disturbance, neither mastoidectomy of the right ear nor myringotomy of the left ear was performed, and the infant made an uninterrupted recovery.

H., aged 2 weeks, was in the pediatric service; his case was classified as a feeding case. The diagnosis was bilateral acute otitis. The drum heads were reddened. There was shortening of each short process, and each light reflex was distorted. There was a distinct bulging of each posterior superior wall. As the infant was making good progress, except for occasional sharp rises in temperature, nothing was done for the ears; this baby also made an uninterrupted recovery.

If only acute otitis caused these systemic disturbances, the matter would be simple; they may, however, also be caused by infections of the nasal sinuses.

J., aged 1 month, who was in the pediatric service, had a condition diagnosed as anhydremia and diarrhea with loss of weight. The otolarynogologic diagnosis was acute infection of the paranasal sinus. After treatment of the nasal sinuses, the same improvement was observed as was noted following myringotomy and mastoidectomy in otitis media. The number of stools decreased; there was a rapid increase in weight, and the temperature curve became flattened.

The condition of M. W., aged 17 months, was diagnosed by a pediatrician as dehydration with loss of weight. The temperature was 101 F. but diarrhea was not present. The otolaryngologic diagnosis was acute infection of the nasal sinuses. Immediately following treatment of the nasal sinuses, the temperature curve flattened, and there was an increase in weight.

If the infants suffered only from acute otitis or acute paranasal sinusitis, the problem would still be simple. As a rule, both nasal sinusitis and acute otitis are present, in which case the patient must be treated for both. Unfortunately, many of these infants are so ill that it is impossible to drain both the ears and the nasal sinuses without producing a fatality, and it is only after careful consultation between the pediatrician and the otolaryngologist that the best method of treatment is chosen.

D. P., aged 1 year, was in the pediatric service with a condition diagnosed as malnutrition. The otolaryngologist diagnosed suppurative ethmoiditis. For twelve days following treatment of the ethmoids, there was a rapid increase in weight; then an acute otitis made its appearance. Myringotomy was performed, and the infant continued to improve. In about fourteen days, mastoidectomy was performed for otologic reasons; the condition remained stationary and there were sharp rises in temperature to 104 F. In my judgment, the rise in temperature was not associated with the condition of the ear, and more active treatment was directed toward the rhinologic condition; as a result, the temperature curve became flattened. The weight again rapidly increased, and the infant improved.

J. M., aged 11 months, was in the pediatric service with a condition diagnosed as malnutrition. The baby was very ill. The otolaryngologist diagnosed bilateral acute otitis and acute sinusitis. The malnutrition began six weeks before with a cold in the head. Two plans were considered: the operation of each mastoid and the active local treatment for the nasal sinus disease, or the operation of each mastoid and the drainage of the maxillary sinuses. The infant was so ill that the chance was taken of controlling the sinus infection by local treatment. The mastoids were drained, and a purulent discharge and pneumoccocci were were found in each. Four days later, the baby died.

In this class of cases, when the ear is responsible for the trouble, there is not the improvement which is usual on the third day after mastoidectomy, and the patient should be treated for nasal sinus disease, if this is present. In a number of infants, this has given satisfactory results.

In infants in whom the mastoids but not the nasal sinuses have been drained a suppurative infection of the sinuses has been found at autopsy.

L. W., aged 2 years, was in the pediatric service with a condition diagnosed as diarrhea, fever and loss of weight. The infant had lost 950 Gm. in weight in

four days. The otolaryngologic diagnosis was otitis of the right ear and acute infection of the right maxillary sinus. The baby was very ill, and because only one ear and one sinus were infected, it was deemed best to have good drainage; hence, the mastoid and the maxillary sinus were drained at the same time. The patient made rapid improvement, and the result was satisfactory.

W. C., aged 1 year, was in the pediatric service with a condition diagnosed as cholora infantum. The otolaryngologic diagnosis was infection of the paranasal sinus and bilateral acute otitis. This child was also very ill. For nine days, he received conservative treatment directed toward the sinus infection. The infant improved, but on the ninth day his condition suddenly became worse, and the pathologic process of the ear was more marked. A bilateral mastoidectomy was performed. At that time no active treatment was directed toward the sinuses. The child was so ill throughout the course of the treatment that the pediatrician did not think it advisable to institute treatment for the sinus condition. At autopsy the nasal sinuses were found filled with pus. As I view it, the sinuses should have been drained early in the treatment.

Infants with malnutrition, infants who refuse food and who have diarrhea, dehydration, fever or prostration or several of these conditions, may suffer from acute otitis, acute sinusitis, acute tonsillitis or acute retropharyngeal abscess. If any of these conditions are present, the pediatrician should treat the patients accordingly.

These infants are very ill, and often it is a problem to decide on the best form of treatment; in spite of every effort, mistakes will be made. The best results can be obtained by complete cooperation between the otolaryngologist and the pediatrician.

CONCLUSIONS

1. The symptoms which lead to the discovery of otitis in infants are much more frequently pediatric than otologic.

2. The conditions which decide the choice of treatment in otitis are more often pediatric than otologic. Refusal of food, dehydration, diarrhea and loss of weight may be the factors that will decide whether myringotomy should be performed. They may indicate mastoidectomy.

3. The otologist and the pediatrician should work in the closest cooperation and have complete confidence in each other.

4. The pediatrician should not confine his work to the general treatment of the child, but should enter actively into the discussion of the need of myringotomy or mastoidectomy.

5. Paranasal sinus disease may cause all the conditions enumerated in this article, except, perhaps, syncopal death. In the presence of these conditions, a positive diagnosis of otitis should not be made unless an objective sign of the otitis exists.

6. If otitis is present, it can always be diagnosed.

7. Paranasal sinus disease unusally coexists with acute otitis; it is as a rule advisable to treat the patient for both. It is often difficult to decide which is the most influential in causing the systemic disturbance.

CHRONIC TEMPOROSPHENOIDAL ABSCESS

DISCOVERED DURING AN APPARENT ACUTE SUPPURATIVE OTITIS MEDIA: REPORT OF A CASE WITH POSTMORTEM OBSERVATIONS

EDWARD R. ROBERTS, M.D.
BRIDGEPORT, CONN.

I do not believe that this case is remarkable in any particular detail, as descriptions of most of the symptoms and pathologic observations are to be found here and there in even a brief search of the literature: but it seems that the combination of the history, certain physical signs, and laboratory and postmortem observations make it an unusual case of chronic temporosphenoidal abscess, in which a diagnosis and a positive localization of the abscess might well be made with reservation.

History.—Mrs. F. B., aged 34, a well developed woman, with a tendency to obesity, was first seen on July 20, 1923. The only complaint was an intermittent pain of about five days' duration in the left ear.

Examination.—Physical examination of the right ear proved that it was normal; the nasal septum was slightly deviated high up and to the right; the postnasal space and larynx were normal, while the tonsils presented nothing noteworthy. The left auditory canal was nearly filled with a grayish-white gelatinous mass, in which could be seen flakes of desquamated epithelium, not unlike that often observed in the canal during an acute infectious process.

Treatment and Course.—This mass was removed with forceps, and the finer particles by irrigation. The membrane of the drum presented a typical picture of acute suppurative otitis media. There was no visible perforation. The tympanic membrane bulged decidedly over its entire surface and was deep red. Following paracentesis, a relatively small amount of serous, blood-stained fluid flowed out through the incision.

The patient received the usual instructions for the care of acute purulent otitis media, and was seen again four days later. The drum did not bulge; injection was much less pronounced, and drainage was free; but, though the pain had almost entirely subsided, the hearing was not improved. The whispered voice was heard imperfectly, as at the first examination. Otherwise the patient appeared to be normal, giving no suggestion of any mental disturbance.

Though instructed to report in forty-eight hours, the patient was not seen until a week later, on August 2. During this period she had had four teeth extracted from the left side, under a gas anesthesia. The dental surgeon reported that three of these teeth were definitely abscessed and the fourth so devitalized that extraction was indicated. At this third consultation, a marked disturbance in the patient's mental condition was at once evident. It was impossible to hold her attention long enough to obtain answers to simple questions. It was possible, however, to test the hearing satisfactorily. It had improved sufficiently to permit a whispered voice to be heard at a distance of 7 feet. The process in the middle ear was apparently subsiding, the discharge now being small. When the husband was questioned, he gave a history of great irritability on the wife's part, as well as mental aberrations, such as forgetting the name of the physician and that of the dentist who had recently attended her, and the location of their offices. Whereas she had formerly been of great assistance in her husband's business, she had of late shown no interest in it.

Though it was felt that perhaps the husband's statements were not entirely reliable, the history was strongly suggestive of a grave mental disorder, or the presence of an abscess of the brain. An immediate thorough physical examination by an internist gave negative results, the rambling conversation and slight serous discharge from the left ear constituting all the abnormal observations. The diagnosis of mental exhaustion due to loss of sleep consequent on the process in the middle ear and reaction from the dental operation or to a toxic disturbance due to absorption from areas of dental infection seemed not unreasonable. No estimate of the amount of sleep lost could be obtained from the husband, as the woman had occupied a room alone for several days previously.

The following day, August 3, the mental condition became more disturbed, and the patient was placed for observation in the Bridgeport Hospital. Examination on admission to the hospital showed: temperature (rectal), 99.8 F.; pulse rate, 90; respiration, 22; white blood cells, 12,200; polymorphonuclears, 81 per cent; large mononuclears, 2 per cent; small mononuclears, 16 per cent, and hemoglobin, 80 per cent.

The patient slept most of this night, the left hand finding its way frequently to the left side of the forehead. When awake, she talked incoherently, and complained of pain over the left eye.

The following day a slight purulent discharge, without odor, appeared in the left auditory canal. When a sister not previously seen was questioned she provided the information that the patient had had a slight fetid discharge from the left ear at intervals for years, concerning which she had been exceedingly sensitive. This statement immediately raised the question of a chronic suppurative process. Ophthalmologic observations on this day (August 4) showed that the retinal veins were dilated and tortuous with a beginning optic neuritis, less than 1 mm. Abscess of the brain then became a definite possibility.

Roentgenograms were made of the skull, and the following report was given: "Roentgenographic examination of the skull does not show any evidence of intracranial pressure. The accessory nasal sinuses are normal except for undeveloped frontals. Both mastoids are sclerotic in type, showing very little cellular structure, the left more than the right."

Throughout the day the patient complained of pain over the left eye and back of the left ear, was restless and talked irrationally, though when quiet she could answer questions intelligently. The spinal fluid examined on this day was obtained under great pressure, spurting a foot and a half. It showed an excess of globulin present; Fehling's solution was reduced; 140 cells per cubic millimeter were present, most of which were small mononuclears. Organisms were not present on culture. The specific gravity of the urine was 1.002; it was alkaline in reaction, and showed the slightest possible trace of albumin. A second white blood count showed 12,200 white cells; polymorphonuclears increased to 89 per cent, large mononuclears diminished to 1 per cent and small mononuclears to 10 per cent. Exploratory operation was advised, but refused by the husband.

The pulse rate now ranged between 80 and 84, though it was once recorded as 60. At times the face became flushed, and the body warm to the touch; at other times the face would blanch, and the body become cold. The patient was much more restless during the succeeding night, voiding urine involuntarily at midnight; later there were twitchings of the left leg, but no complaint of pain. In the morning the patient was able to answer questions without evidence of a clouded intellect. A scant discharge from the ear was observed during the course of this day.

On August 5, a neurologist considered abscess of the brain, localized encephalitis, possibly related to a previous illness, or a right cerebellar disturbance, as probable diagnoses, but advised against operative intervention. The rectal temperature was 99 F.; the pulse averaged 74, but dropped to 68 and 65 on two counts. Respirations were 22 throughout the day.

A slight spasticity of the right leg and a slight extensor response were present. The neurologic consultant had attended this patient in her last confine-

ment eight years previously. During her convalescence at that time a thrombotic disturbance had developed, in his opinion involving the motor area of the left cerebral cortex.

On the morning of August 6, the optic neuritis was found to have increased, the right disk to plus four, and the left to plus three. It was now felt by the majority of those in attendance that the left temporosphenoidal lobe should be exposed through the mastoid, but the family refused operative intervention. Through this day the general condition seemed about the same; temperature by rectum was 99 and 99.5 F.; respiration was 20 and the pulse was of fair quality, ranging from 60 to 70. During the night there was involuntary micturition in small amounts about every hour, the patient turning a good deal and frequently rubbing her head. She was not talkative. There were no muscular twitchings.

On August 7, at 7 a. m., the patient was seized with a slight generalized convulsion of short duration. At 9:15 a. m. there was vomiting for the first time, and she relapsed into semicoma. A divergent squint developed suddenly, accompanied by increased hypertonia of the right leg. Shortly afterward moderate generalized convulsions began to occur at intervals, the pulse becoming rapid, weak and irregular.

The patient was now manifestly in a serious condition, and family consent to a cerebral exploration was given. During the preparation for operation several generalized convulsive seizures took place.

A radical mastoid operation was hurriedly performed. The bone was not especially dense, but no condition suggestive of a purulent or destructive disease of the bone was encountered, except over the antrum and tegmen tympani, where the cellular structure was rather less resistant and darker. The usual exposure of the temporosphenoidal lobe was made, the decompression being first completed in the floor of the middle fossa. The exposed dura was normal in appearance, except for a small area of hyperemia over the softened cellular structure.

Just before the cranial cavity was opened, under a slight anesthesia, the patient apparently had a generalized convulsion at the outset of which respirations ceased, and this function was not resumed. Epinephrine was given, and the operation was continued, as the rate and volume of the pulse were not affected. Because of the area of dural congestion, the brain was first incised from below, but no pus was encountered. This work had been done with the aid of artificial respiration. At this time the pulse was beginning to fail, and epinephrine was given into the cardiac muscle, but there was no response. Death followed shortly.

Permission was given to remove the skullcap. An area of adherent dura was found over the leg area on the left, and sectioning disclosed a large, chronic, nonencapsulated abscess containing rather thin, grayish pus, situated high up and well back in the temporosphenoidal lobe. Cultures from this fluid did not disclose the offending organism, but developed a mixed growth with an unidentified bacillus predominating.

COMMENT

It does not seem that this case can fairly be placed in that group of cases mentioned by Eagleton [1] in which a diagnosis was not made earlier, for the reason that the symptoms in this group came almost simultaneously with symptoms of cerebral compression. Moreover, it is felt that the localizing symptoms, which appeared rather early in this brief illness, only added confusion to the clinical picture.

No history of any past illnesses of consequence was given by the patient on the occasions of her first two visits, when cerebration was normal.

1. Eagleton, Wells P.: Brain Abscess, New York, The Macmillan Company, 1924, p. 155.

Up to the day on which signs and symptoms of an acute illness appeared, the general health had been excellent. There was no history of recurrent headaches. The pain in the head could readily be associated with an acute infection of the middle ear, and later with the reaction following the dental operation.

There was no history of irregular vomiting or convulsive seizures. There were, of course, no temperature records; but those recorded, even those taken earlier during the period of observation, were elevated rather than subnormal.

It may be of interest to note that most of the cells of the spinal fluid were mononuclears, which are looked on as indicating a subsiding process (Eagleton). Considering the short duration of this illness and the increasing severity of the symptoms as they finally developed, it would seem that a polymorphonuclear stage of reaction may not always be demonstrable in the spinal fluid.

Vomiting, like headache, is often an early symptom suggestive of cerebral suppuration, but it was not manifested until late in the stage of cerebral compression, five hours before death occurred, and not until ocular paralysis had developed.

The temperature and pulse curves are likewise interesting. The temperature was only slightly subnormal at intervals. No pulse rate was recorded under 72 except on two occasions, and these were when the patient was in semicoma, long after other signs of cerebral compression were first manifest.

A naming aphasia developed on the second day before death, but it was transient. Its demonstration was not again attempted.

In temporosphenoidal abscess, neurologic observations in the lower extremities alone appear not to be the rule, and when they do appear, they usually follow disturbances in the face and arm. The conditions in this case may be explained by a downward, so-called conical pressure catching the leg fibers on the left side before they have crossed or on the right after the decussation.

CONCLUSIONS

It would seem that this case might emphasize these points:

1. In a case of a suppurative otitis with the slightest mental disturbance the matter of previous history should be looked into with the greatest care.

2. Even in acute or apparently acute infections of the middle ear the possibility of abscess of the brain should always be borne in mind.

3. The symptoms of abscess of the brain may not always appear in definite and fixed groups with regard to time.

SOME PHASES OF ACCESSORY SINUS DISEASE*

M. C. MYERSON, M.D.
NEW YORK

I shall endeavor to give some impressions and experiences in the field of sinus disease which, I hope, will provoke thought and discussion. One is impressed with the relative frequency of the ethmoid operation and the comparative infrequency of operations on the maxillary sinus. Patients are being treated for ethmoiditis when active disease is present in one or both antrums. Every one sees persons who have had a series of ethmoid operations and are little benefited by them. It is little wonder, therefore, that many physicians urge that the ethmoid operation be reserved only for the most urgent indications, such as threatened loss of vision or impending intracranial complication. The dissatisfaction with the results of this operation seems to be well founded in the minds of many rhinologists. However, the basis for the seemingly large percentage of unsatisfactory results has not yet been found. Certainly, a contributing factor is the frequently overlooked antrum.[1] In addition, the general metabolic state, the endocrine balance and the diet are important. Their influence is worthy of more frequent mention.

The following case demonstrates my oversight in this regard:

A boy, aged 11, was referred for examination on account of persistent nasal discharge of a mucopurulent character, which had lasted for eight months. The examination suggested a pansinusitis on each side. Because of the generalized character of the nasal condition, the possibility of a protein sensitization was considered. He was referred to Dr. F. E. Stone, for physical examination, which revealed a slow pulse, 58 beats per minute, obesity, general sluggishness, coarse hair and a subnormal temperature. These characteristics suggested hypothyroidism. Six grains of thyroid extract was administered daily and all the nasal symptoms disappeared within a week. He has now been free from symptoms for seven months.

Transillumination and the roentgen ray, although not infallible as diagnostic aids, could be made of more value if the patients were instructed not to blow their noses and so empty out the retained exudates just before examination. It would also appear that few roentgenologists are familiar enough with the work of rhinologists to understand the clinical and pathologic phases of sinus disease. Roentgenologists should be stimulated and encouraged to take an active interest in diseases of the

* From the Department of Laryngology, King's County Hospital, service of Dr. H. Arrowsmith.

* Read before the Eastern Section, American Laryngological, Rhinological and Otological Association, Jan. 8, 1927.

1. Stauffer, Fred: The Cure of Chronic Suppurative Nasal Conditions by Draining Through the Maxillary Antrum, Ann. Otol. Rhin. & Laryng. **35**:845, 1926.

accessory sinuses. It has been my experience that conditions exposed at operation or at autopsy could frequently be traced on the film, whereas before they may have been overlooked.

From the clinical standpoint, it should be understood that it is frequently impossible to diagnose the presence or absence of sinus disease at a single sitting. Repeated examinations are usually necessary before one is able to determine the exact state of affairs and the best method of dealing with the existing condition.

Dennis and Mullin [2] have on several occasions stressed the latency of antrum disease. Bodkin [3] found antrum disease in forty-one of fifty cases of mastoiditis in which operation was performed. Miller [4] found evidence of unsuspected maxillary sinus suppuration at autopsy in three patients who died of cardiac disease. Many times a chronically discharging ear has dried up immediately after an antrum has been drained or after an infective nasal condition has been properly treated.

Dennis [5] advocated opening the antrum for diagnostic inspection in certain selected cases. My experience has been such as to support this proposal. The time will come when the conscientious rhinologist will open the antrum in the presence of disease pointing to focal infection as readily as he removes tonsils for the same reason today. This applies, of course, to cases in which all other sources of infection have been eliminated. When one is looking for infection it is not sufficient that the roentgenogram and transillumination are negative. Experience has shown that even the absence of pus or changes in the mucous membrane of the middle meatus area, together with a clear return of the irrigating fluid, does not rule out the presence of disease in the antrum. There have been several instances in which transillumination and roentgenograms were negative and, in addition, the irrigating fluid was returned perfectly clear. However, exploratory operation disclosed pus and polypi. In many cases absolute certainty that disease is present in an antrum can be afforded only by exploratory opening. The following experiences are mentioned in connection with the foregoing observations:

A man, aged 52, presented himself with a history of chronic illness for a period of two and one-half years. He had a moderate secondary anemia, and complained chiefly of being tired and run down. He had what he described as a constant "cold in the head," and had traveled far from home for relief. During his travels, his tonsils were removed and his condition was diagnosed tuberculosis.

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2. Dennis, F. L., and Mullin, W. V.: Value of Direct Inspection in the Diagnosis of Chronic Maxillary Sinus Disease, Laryngoscope **32**:300 (April) 1922.

3. Bodkin, H.: Maxillary Antrum in Mastoiditis, J. Laryngol. Rhinol. & Otol. **33**: 200 (July 18) 1920.

4. Miller, J. W.: The Nasal Accessory Sinuses in Cardiopathies, Arch. Int. Med. **34**: 177 (Aug.) 1924.

5. Dennis, F. L.: Accessory Nasal Sinus Infection with Complications, etc., Tr. Am. Acad. Ophth. & Otolaryngol., 1923, pp. 276-281.

The diagnosis of tuberculosis, however, could not be substantiated. The roentgen ray, transillumination and antrum irrigation gave positive results for the left antrum. The roentgen ray showed a slightly cloudy right antrum, but this cavity yielded negative results by transillumination and irrigation (fig. 1). Operation (Caldwell-Luc) was performed on the left antrum. A small area of polypoid involvement and no free pus was found. Because of the small amount of disease in the left antrum it was suggested that the other antrum be investigated while the patient was still on the table. An opening through the anterior wall of the supposedly negative antrum revealed many large polypi bathed in thick, tenacious, gelatinous pus. The general condition of the patient improved markedly after the antrum operations, and he did not suffer from the "constant cold" he had previously complained of.

A lady, aged 43, was treated for a sinus condition fourteen years before admission. She had had a temperature of 100 F. or a little more for three weeks. The roentgen ray, transillumination and irrigation gave positive results for the

Fig. 1.—The left antrum is cloudy, while the right antrum is much less so; yet exploration of the right antrum revealed more pronounced disease. Roentgenogram by Dr. A. A. Rendich.

right antrum, while the left antrum was negative to every test (fig. 2). Operation revealed considerably more suppurative disease on the left, supposedly healthy side than on the positive right side. In addition, the patient had a definite ethmoidal suppuration of the left side, on which operation was performed.

These cases and others demonstrate that irrigation frequently does not reach pus that may be adherent to the cavity wall, or if it does, there is not sufficient pressure to dislodge it. This can be readily understood when one considers that the antrum has many surfaces and angles, most of which are not in the direct path of the stream of fluid introduced by way of the natural orifice or a puncture opening.

Apparently the antrum is being slighted in the investigation of chronic nasal disease. Rhinologists hesitate to puncture the antrum, and

do not sufficiently appreciate the value of passing a cannula through the natural orifice or an accessory orifice of the antrum. In a large percentage of patients, between 50 and 60 per cent, this can be accomplished. One would do well to have at his disposal a large variety of cannulas, for the relation of the middle turbinate to the lateral wall is by no means constant. In this manner the 50 per cent successful natural orifice irrigations which Yankauer [6] has been able to carry out with his cannulas could, I am sure, be appreciably increased. The cannulas of Haskins and Yankauer are similarly constructed and similarly effective. When neither of these can be passed, one may be successful

Fig. 2.—The left supposedly healthy antrum was found markedly diseased at exploratory operation. Roentgenogram by Dr. R. A. Rendich.

with the Pierce cannula. In addition to these, one may utilize, properly bent, eustachian catheters, which, when successfully passed, furnish a much larger stream of fluid.

Shambaugh [7] recently cautioned against the increased frequency of ethmoid operations. My observations of the results of ethmoid operations would indicate that insufficient thought and preparation have been given to these procedures. In the hands of the unskilled and, I might add, the untaught, some of the ethmoid instruments are particularly

6. Yankauer, Sidney: Personal communication to the author.

7. Shambaugh, G. E.: Fads and Fancies in the Practice of Otolaryngology, J. A. M. A. **87:** 1720-1723 (Nov. 20) 1926.

dangerous. Just recently, a patient whose sphenopalatine vessel was lacerated as the result of such a procedure, was brought to the hospital on the ambulance. The profuse hemorrhage necessitated the ligation of the external carotid artery and two transfusions. In ethmoidectomies performed for suppurative disease, the comparatively infrequent involvement of the sphenoid has been mentioned by Fraser.[8] He quoted Oppikoffer as having found but three sphenoidal sinuses involved in a series of 155 ethmoid operations. Although I have not accurately compiled my cases, I can recall but a half dozen instances of sphenoidal suppuration in the last 100 ethmoidectomies that I have performed or directly supervised. Such being the case, and if it is in accord with the results of others, puncture of the sphenoidal sinus for diagnostic

Fig. 3.—Right antrum apparently filled with lipiodol. Roentgenogram by Dr. R. A. Rendich.

purposes or for the introduction of lipiodol for mapping purposes should not receive consideration as a frequent or routine procedure.

At present, attention is being directed to the introduction of opaque mediums into the maxillary and sphenoidal cavities. The readily accessible maxillary cavities, with their safety of approach, will, no doubt, provide the greatest field of usefulness for this type of investigation. It is in the obscure or unsuspected antrum that lipiodol may bring to light evidence of polypi, thickened membrane, inspissated pus or granulations. Certainly a more accurate knowledge of the physiology and the processes of disease of the cavity will result from this procedure.

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8. Fraser, J. S.: Frequency of Sphenoidal Sinus Operations, J. Laryng. & Otol. **39:** 393-396 (July) 1924.

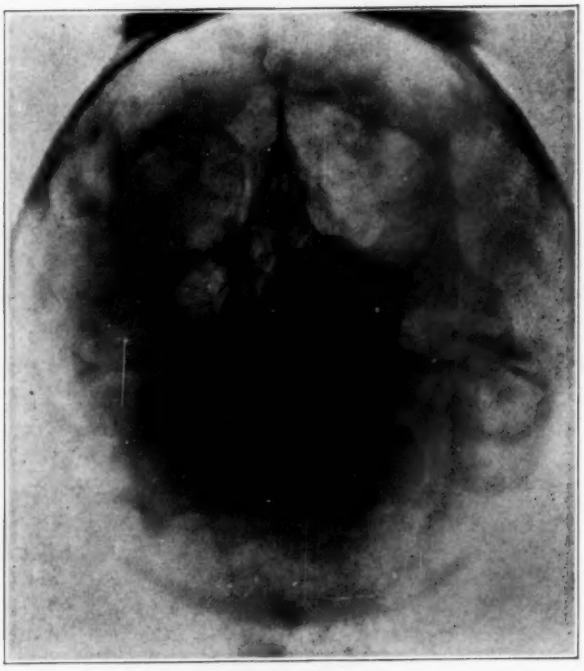

Fig. 4.—Same right antrum as in figure 3, roentgenographed from proper angle. Here the lower half of the antrum is seen to be filled with diseased tissue. Polypi and granulations were found at operation. Roentgenogram by Dr. R. A. Rendich.

Fig. 5.—Evidence of disease in medial half of right antrum; left antrum also. Roentgenogram by Dr. R. A. Rendich.

The ronentgenograms show the value of the use of lipiodol.

The following cases are reported as unusual incidents in sinus infection.

REPORT OF CASES

CASE 1.—*A case of aseptic cavernous sinus thrombosis with spontaneous recovery* (figs. 7, 8 and 9).

F. L., aged 39, was admitted to the service in March, 1926, complaining of headache, pain, redness and bulging of both eyes. For six days before admission he had suffered with headache and nasal discharge. Twenty-four hours after the

Fig. 6.—Same patient as in figure 5, twenty-four hours later, showing that lipiodol has entirely disappeared. Roentgenogram by Dr. R. A. Rendich.

onset of the trouble his left eye gradually bulged, and within another day his right eye acted in the same manner. Then there apparently was a progressive bulging of both eyes. On admission he presented a textbook picture of cavernous sinus thrombosis, yet his temperature was normal, the leukocyte count was 6,700, polymorphonuclears numbered 63 per cent and he felt perfectly well, except for the protruding eyeballs and the associated symptoms. Drs. Ohly, Hargitt and Moehle of the Ophthalmologic Service pronounced the case one of cavernous sinus thrombosis. Wassermann tests of the blood and spinal fluid gave negative results. Evidence of orbital inflammation was not seen at any time. Culture from the nose showed a pneumococcus, type four, probably streptococcus. His intranasal condition subsided within forty-eight hours after admission. Nothing of an operative

nature was done at that time or since, for no suppurative process was seen and there was nothing in the nose to indicate the necessity for surgery. Repeated ophthalmoscopic examinations showed engorgement of the retinal vessels, with exudate and edema in the retina. The orbits gradually receded until they reached their present position about six months after admission (figs. 7, 8 and 9). At present, ten

Fig. 7.—Case of cavernous sinus thrombosis with spontaneous recovery; picture taken shortly after admission in March, 1926.

Fig. 8.—Same patient as in figure 7, March, 1926.

months since the patient was admitted, one is impressed with the fact that the return flow of blood to the orbit has not been seriously interfered with, for markedly dilated venous channels are seen on the conjunctiva. The retinal veins also show increased dilatation, while there is some degree of edema.

Eagleton [9] has made it clear that thrombosis is the attempt of nature to overcome the approaching infection, and that phlebitis is the direct result of the active inflammatory process. In case 1 phlebitis evidently was not present, and the infection was of such low virulence that it was combated at once and thoroughly. Dwight and Germain [10] recorded fourteen of 182 cases of cavernous sinus thrombosis that healed spontaneously. I am not certain whether a case has been recorded in which the process was aseptic apparently from its inception.

CASE 2.—*A case of long standing frontal sinus suppuration in which nature performed a partial Lynch-Bárány operation* (fig. 10).

A man, aged 63, had been suffering for three and one half years with a constant swelling at the inner angle of the right orbit, which first appeared after a severe "cold." The swelling would increase about three times a day, and again during the night. He would awake in the morning with the right eye closed.

Fig. 9.—Same patient as in figures 7 and 8, six months later, showing recovery from thrombotic process of cavernous sinus.

Pressure on the swelling would cause a flow of pus from his nose, which afforded relief. By this means he kept himself comfortable between swellings. When he caught "cold" or drank wine the swelling would increase. He had been drinking the night before he entered the hospital presenting a large swelling above and internal to the right eye. Some edema was also seen in this region. There was considerable displacement of the orbit downward and outward. His temperature was 102 F., and his pulse rate 90 per minute. He was suffering with severe right frontal headache, and his right eye was completely closed.

Laboratory work was not done for the patient, because an operation was performed immediately after admission. With an aspirating syringe, 18 cc. of thick greenish pus was removed from the involved area. A Killian type of incision was made and the frontal cavity explored. A large cavity was encountered from which considerable pus and detritus were removed. The outer perpendicular wall presented a small perforation from which pus was oozing. This proved to be a

9. Eagleton, W. P.: Cavernous Sinus Thrombophlebitis, New York, The Macmillan Company, 1926, p. 121.

10. Dwight, E. N., and Germain, Harry: Thrombosis of the Cavernous Sinus, Boston M. & S. J. **146**:456 (May) 1902.

septum, and it was removed. Its removal uncovered a large accessory cavity containing considerable pus of the type previously encountered. I was unable to find a nasofrontal passage, but a fistula was found leading into the posterior ethmoid region. An ethmoidectomy was performed after the frontal sinus was made to communicate in its entire anteroposterior length with the nasal cavity. The external wound was closed without using a drain. The patient has been entirely free from symptoms during the ten months since the operation. The satisfactory outcome is no doubt due to the long period during which nature localized the infection, the operation simply evacuating the end-products of nature's efforts. The pus obtained from the sinus at operation was found to be sterile on culture.

CASE 3.—*A case in which a boy, aged 5, died of the intracranial complications of a suppurative sphenoiditis.*

A boy, aged 5, was admitted to the hospital in a semiconscious condition, presenting swelling and edema of the upper lid on the left side, a rigid neck and

Fig. 10.—Extensive suppurative disease of the right frontal sinus with displacement of the orbit. Roentgenogram by Dr. R. A. Rendich.

palpable cervical glands posteriorly on the left side. Examination disclosed a beginning meningitis. The next day his condition was worse. The left eye was practically closed, slight proptosis was present and both fundi showed a blurring of the disks. Because of the unilateral symptoms, the eye and the glands, and a positive roentgenogram for involvement of the posterior ethmoid region, together with the general condition of the child, an ethmosphenoid operation was decided on. Under procaine hydrochloride anesthesia, which was no doubt aided by the stuporous condition of the child, the ethmoid cells were exenterated. A small streak of thick pus was encountered in the posterior ethmoid region, and the sphenoidal sinus was found markedly edematous, with a drop of thick pus in it. Just before operation the blood count showed 24,500 white cells, with 82 per cent polymorphonuclears and 3 per cent myelocytes. The Wassermann reaction was negative and blood cultures were not at any time positive. The spinal fluid was under slight pressure; two specimens were contaminated by blood so that they were not of any value for laboratory purposes. The patient did not progress well, and died about thirty-six hours after operation. Of importance is the fact that a large quantity of pus was seen coming from the nasopharynx the day before he

died. Eagleton[9] has called attention to the formation of an abscess which empties itself frequently through the sphenomaxillary fossa in cases of cavernous sinus thrombophlebitis.[9]

Autopsy by Dr. W. W. Hala revealed the following: On opening the skull a clear, free fluid was present over the convex surface of the brain. The brain was somewhat adherent at the base, particularly to the clivus of the occipital bone, where the dura showed several small petechiae and a yellowish fibrinous material. When the dura at this point was stripped, an abscess was found. The left sphenoid which measures about 3 mm. in diameter and 4 mm. in depth showed a purulent material. The right sphenoid showed edematous soft tissue but no pus. The cavernous sinuses were filled with thick pus. Within the orbital cavity of the left side the tissues were edematous.

Death was caused by purulent sphenoiditis, epidural abscess and cavernous sinus thrombosis.

Sphenoiditis is comparatively of infrequent occurrence at the age of 5, and this case is an example of what trapped infection in the sinus cavity of a child may lead to.

30 East Fortieth Street.

EXPLANATION FOR THE SYMPTOM OF PARACUSIS WILLISI

A DEMONSTRATION*

GEORGE E. SHAMBAUGH, M.D.
CHICAGO

Ability to hear better in the midst of noisy surroundings is a conspicuous symptom of some patients with defective hearing. It is usually limited to hearing of the spoken voice, and is observed apparently only when deafness is the result of obstruction in the conduction mechanism. It is, of course, necessary that both ears be involved and that the defect in hearing be fairly well developed before this symptom may be recognized. The paracusis becomes increasingly conspicuous as the deafness progresses; it persists in those cases in which, in addition to the defect from obstruction, the secondary degeneration of the eighth nerve, which sooner or later complicates many advanced cases of obstructive deafness, all but wipes out the hearing for the voice.

That some deafened persons actually hear the voice better in noisy than in quiet surroundings, better even than does a person with normal hearing, is readily demonstrable. While I was riding on the train with a person who had a serious defect in hearing, the result of rigidity of the conducting mechanism, I noticed that when the train was in motion he could tell me what people were saying at a distance of several seats, and I could not hear a single word; but the moment the train stopped, I could tell him what they were saying, while he in turn could not hear a word of their conversation.

Two possible explanations suggest themselves. The first is that extraneous sounds in some way actually increase the acuteness of the response in the hearing mechanism. The other is that the symptom of paracusis is occasioned by the fact that in a noise the person with normal hearing suffers a handicap in hearing because of the confusion created by these extraneous sounds, and involuntarily, therefore, raises his voice. The person with obstructive deafness, protected from the confusion of extraneous sounds because of his deafness, sometimes readily hears the raised voice in such surroundings even better than the person with normal hearing.

As regards the first proposition, namely, that the ability to hear is actually increased in a noise because of the stimulation of the hearing mechanism, two hypotheses have been advanced. One is that in cases of deafness caused by rigidity of the conducting mechanism the extrane-

* Read before the American Otological Society, New York, May 20, 1927.

ous sounds temporarily overcome this rigidity, thus making it possible to hear the spoken voice better. This seems to have been expressed first by Buck.[1] It was later voiced by Politzer.[2]

The other hypothesis is that extraneous sounds, by stimulating the end-organ of hearing, in some way produce temporarily an increased sensibility of this mechanism, and for this reason a person hears better in a noisy place. This idea was expressed by Urbantschitz.[3]

Neither of these hypotheses makes a strong appeal. In the first place, the idea that the conduction of sound impulses is so improved by extraneous noises as to make it possible for a deafened person to hear the voice better than a normal person does not seem probable when one remembers that the cases in which paracusis is most conspicuous are those in which the patient suffers from bony ankylosis of the stapes, a condition which is not appreciably loosened up by any method.

The second hypothesis, namely, that in the presence of extraneous sounds the nerve itself, which is the sound-perceiving mechanism in the labyrinth, becomes hypersensitive, thus rendering it possible for the deafened person to hear the voice better, is also hard to accept. This hypothesis presupposes, of course, that sounds other than the spoken voice should also be heard better. This, however, does not appear to be the case. Moreover, if this hypothesis were the true explanation for paracusis, there does not appear to be any reason why its phenomenon should be restricted to but one type of deafness, namely, that resulting from rigidity of the conducting mechanism; one should expect it as well in cases of partial nerve deafness and also in persons with normal hearing.

The following observation serves to throw an interesting sidelight on the explanation of this phenomenon. A person suffering from otosclerosis, that is, with bony fixation of the stapes, when riding in a car, especially with the windows open, notices that the increased effort made by a person with normal hearing in order to be heard while passing another train is kept up unconsciously for some moments after the train has passed, and that during this interval his voice sounds extremely loud. If the hypothesis were correct that extraneous sounds increase the ability to hear by either one of these phenomena, then the increased noise of the passing train should increase the hearing of the deafened person only during the time that the train is actually passing.

There is left, the possibility that the second explanation may be the true one, namely, that the increased ability to hear the voice in a noisy place is only apparent. This is the conclusion reached by Kranz,[4] Knud-

1. Buck: New York M. Rec., July 5, 1875.
2. Politzer: Arch. f. Ohrenh. **16**:307, 1880.
3. Urbantschitz: Monatschr. f. Ohrenh. **46**:741, 1913.
4. Kranz: Ann. Otol. Rhinol. & Laryngol. **33**:283, 1924.

sen [5] and Pohlman.[6] The explanation was first suggested by von Throltsch.[7]

The question arises, Why is this phenomenon observed only in cases of obstructive deafness and never in nerve deafness? These two types of deafness differ fundamentally in two respects: the part of the tone scale involved and the status of bone conduction. One of these two conditions should, therefore, account for the fact that paracusis is observed in one type and not in the other. In deafness due to rigidity of the conducting mechanism, the defect involves chiefly the lower end of the tone range; there is in addition an actual increase in the response by bone conduction. In primary nerve deafness, the defect involves chiefly the higher tones, and there is a lessened response by bone conduction.

Does increased bone conduction play any part in the production of paracusis? This might be suspected if the phenomenon developed only while riding in a car, where actual contact with the vibrating surroundings—the floor, the seat and the sides of the car—might be suspected of aiding hearing. The fact, however, that the phenomenon of paracusis develops as readily outdoors disproves this hypothesis. The phenomenon of paracusis seems, therefore, to be dependent on the different parts of the tone scale involved in the two types of deafness. In deafness due to obstruction in sound conduction, the defect is chiefly for the lower tones, and it is mainly the extraneous sounds in this part of the range that confuse the hearing for the voice in the person with normal hearing. The person with a defect in hearing caused by fixation does not, of course, experience this handicap. Nerve deafness involves the upper end of the tone scale primarily; therefore, a person suffering from nerve deafness experiences the same confusion in hearing the voice in the presence of extraneous sounds as does a person with normal hearing, for the reason that these extraneous sounds are for the most part sounds in the lower tone ranges and are heard equally well by the normal and by the deafened person.

The following interesting questions arise:

1. Would a person suffering from deafness restricted to the lower tone ranges, as a result of changes in the labyrinth, develop the symptom of paracusis, provided this nerve deafness was partial and bilateral, a prerequisite for the development of paracusis in any case? Occasionally I see cases of nerve deafness in which the defect is restricted to the

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5. Knudsen: Science **62**:109, 1925.

6. Pohlman, A. G., and Krantz, F. W.: Quantitative Tests on Bone and Air Acuity in Paracusis Willisi; Inter-relation of Audiometric Tests, Arch. Otolaryng. **3**:136 (Feb.) 1926.

7. Von Throltsch: Lehrbuch der Ohrenheilkunde, ed. 6, 1877, p. 253.

lower tone range, but I do not recall ever observing this as a bilateral phenomenon.

2. In a person with obstructive deafness in which paracusis is a conspicuous symptom, would paracusis fail to develop in the presence of extraneous sounds restricted to the higher tone ranges? This would be a logical sequence if this proposition were correct, for these higher extraneous sounds should produce the same confusion for hearing the voice in the person deafened by an obstructive lesion which interferes only with the hearing for low sounds as in a normal person.

3. Would a person suffering from partial deafness as the result of a bilateral involvement of the nerve of hearing experience the phenomenon of paracusis in the presence of extraneous sounds which in themselves were largely in the upper tone ranges?

These are all logical conclusions, and are what one should expect to find if my explanation for the development of paracusis in obstructive deafness is correct.

It is of interest to note that the hypothesis that extraneous sounds temporarily increase the ability to hear the spoken voice has been made the basis for therapeutic measures to improve the hearing in obstructive deafness. A number of years ago, Dundas Grant [8] proposed vibrating massage of the spine in cases in which paracusis Willisi was a symptom. Recently a physicist,[9] himself a victim of deafness, observed that he heard the voice better when in noisy surroundings, and, believing that this phenomenon was due to a stimulation of the hearing mechanism, he devised an electrical apparatus for producing vibrations which are below the threshold of hearing, that is, below 16 double vibrations. By the repeated application of this "treatment," he expected to bring about a permanent improvement in hearing. This device is called the *Audotor,* and is for sale to physicians and patients.

These therapeutic propositions fail to recognize a fact which has long been established, namely, that the actual changes producing the deafness in these cases are almost without exception permanent changes—bony fixation of the stapes—and as such could not be influenced by local massage. They fail also to appreciate that this type of deafness progresses in persons with paracusis whose surroundings continually bring out this symptom particularly well, for example, employees of a railroad, exactly as it does in all others. In other words, there is no reason to suppose that the development of the phenomenon of paracusis Willisi serves as a means of bringing about any permanent improvement in hearing. This method of treatment is, moreover, based on an explanation of the

8. Grant, Dundas: Deutsche Otol. Gesellsch. 1898, p. 193.

9. Eldred: Literary Digest, May 2, 1925.

phenomenon of paracusis which is palpably erroneous, since this phenomenon is not accounted for by any increase in the patient's power of hearing.

Efforts to demonstrate the facts regarding the function of hearing in the presence of extraneous sounds are handicapped by the difficulty of measuring the intensity of sounds necessary for hearing both in quiet surroundings and in the presence of extraneous noises. It occurred to me that the audiometer should provide a suitable mechanism for making such measurements, and thus demonstrate definitely whether a person with the symptom of paracusis actually did hear better in the presence of extraneous sounds. With this in view I undertook a series of experiments with the assistance of Dr. Hagens, Dr. Holderman and Dr. Watkins, who have been working with me in an extensive survey of the children in public institutions for the deaf. We used for this purpose the Western Electric 2A audiometer loaned by the Graybar Electric Company. Two series of experiments were carried out. In the first series, we used an ear-piece having a solid rim covered by a soft rubber pad to exclude extraneous sounds, and in the second series we used an ear-piece furnished by the Graybar Electric Company in which the contact rim was perforated by a series of openings to permit extraneous sounds to reach the ear being tested.

FIRST SERIES OF EXPERIMENTS

The ear-piece with the solid rim was used.

Experiment 1.—Dr. Holderman, who had normal hearing, tested the right ear while the train was at the station, with the left ear open and with it closed, and then while the train was in motion with the left ear both open and closed. In chart 1 it will be observed that little difference was noted, whether the opposite ear was open or closed, and that there was a decided lowering of the hearing throughout the tone range when the train was in motion. The conclusion was that a person with normal hearing finds a decided lowering of the acuteness of hearing throughout the tone range when in the midst of noisy surroundings.

Experiment 2.—Dr. C.,[10] with advanced otosclerosis and with the symptom of paracusis well developed, had his hearing tested in the same manner at the station with the opposite ear open and then closed, and while the train was in motion with the opposite ear both open and closed. In chart 2 it will be noted that, using a solid ear-piece, no appreciable difference was noted in any part of the tone range, an identical audiogram being recorded for each of the four tests. When this

10. Dr. C., aged 55, had had an insidious development of defective hearing, which had begun thirty years before; tinnitus was more or less constant. One sister and one brother also had defective hearing. He could hear a whisper 6 inches away on the right side; on the left side, close to the ear. The Weber test was positive on the left side; the reaction to the Schwabach test was prolonged, and the reaction to the Rinne test was absolutely negative on both sides. The lower tone limit was: *A* barely heard on the right, and not heard on the left; c^4 was slightly shortened, right and left; Galton Whistle (Edelmann), right and left, 7.

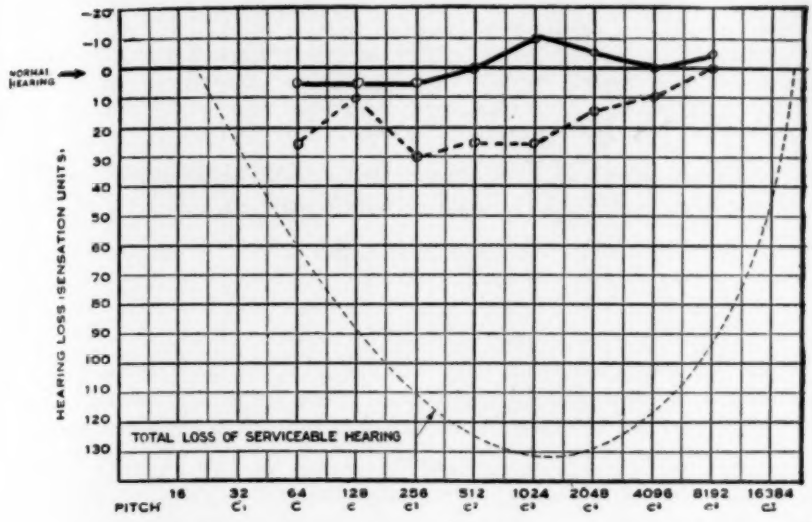

Chart 1.—Test of person with normal hearing, using closed ear-piece in the presence of extraneous noise. In this chart and in chart 2, the solid line represents the hearing while the train was in the station, and the broken line is the curve of hearing while the train was in motion.

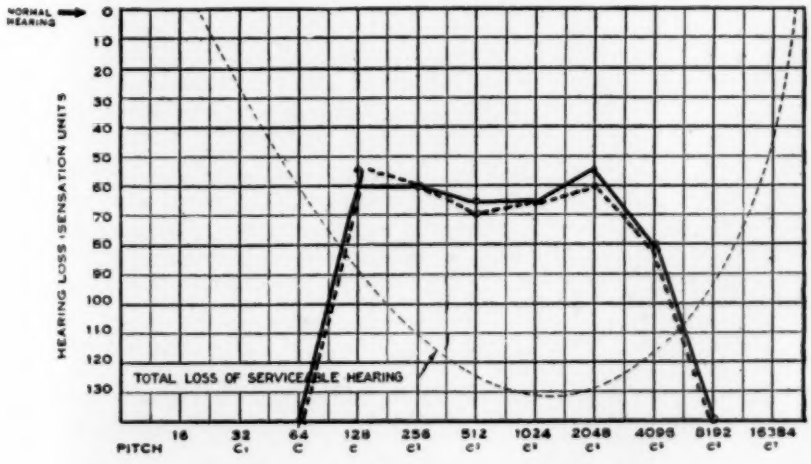

Chart 2.—Test of person with advanced otosclerosis, using closed ear-piece.

result is compared with that in chart 1, it is seen that whereas the person with normal hearing experiences increased difficulty throughout the tone range while the train is in motion, a person with advanced deafness which is the result of stapes fixation hears the audiometer exactly the same whether the train is standing still or is in motion.

SECOND SERIES OF EXPERIMENTS

In the second series of experiments comparisons were made with the ordinary closed ear-piece and the one with openings.

Experiment 1.—Dr. Moore, who had normal hearing, was tested while the train was in motion. Chart 3 shows that with the closed ear-piece there was a defect in the hearing, chiefly for the lower tone range, and that it made little if any difference whether the opposite ear was open or closed. There was a defect in hearing throughout the entire tone range when the open ear-piece was used. The hearing was only slightly better when the opposite ear was closed. It was noted that the defect in hearing produced by extraneous sounds while riding on the train was greater for the lower part of the tone range, but the depression was present throughout the entire tone range, and would therefore involve the part most essential to hearing conversation. The conclusion was that a person with normal hearing, when in the presence of extraneous noises, suffers a defect in hearing restricted chiefly to the lower tone ranges. This defect is increased and involves all parts of the tone range, as the extraneous sounds are increased when riding on the train.

Experiment 2.—Dr. C.,[11] who had obstructive deafness, made tests with the closed and open ear-pieces, both while the train was standing at the station and when it was in motion. Since throughout the first series of experiments it had been determined that in this person no difference in the hearing was recognized whether the opposite ear was open or closed, this detail was not carried out. Chart 4 shows, in the first place, that the difference in the audiograms obtained depended chiefly on whether the closed or the open ear-piece was used. When the open ear-piece was used, which permitted extraneous sounds to impinge on the ear being tested, a lowering of the hearing in the lower part of the tone scale occurred. The lower limit for audition, which was distinctly elevated when the ordinary ear-piece was used, was still more elevated when the open ear-piece was employed. At the same time, the lowering of the upper tone limit which was marked for this person when the closed ear-piece was used was still more appreciably lowered with the open ear-piece. In other words, the hearing throughout the tone scale was made worse when extraneous sounds were allowed to reach the ear being tested. This impairment of the hearing resulted in a more extensive elevation of the lower tone limit and more extensive lowering of the upper tone limit, as well as a lowering of the acuteness of the perception throughout the middle ranges. Tests with the closed ear-piece showed an actual impairment rather than an improvement in hearing when the train was in motion. With the open ear-piece, the increased impairment in hearing when the train was in motion possibly was not so apparent.

CONCLUSIONS

1. A person with normal hearing in the midst of extraneous sounds experiences diminished hearing throughout the tone range. This diminished hearing is greater for the lower tones.

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11. The same person tested in experiment 2, first series.

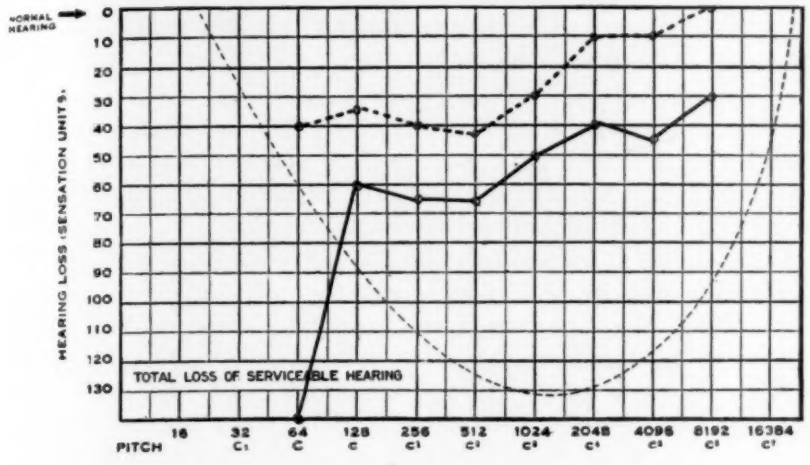

Chart 3.—Test of person with normal hearing using both ear-pieces. The broken line is the curve of hearing with the closed ear-piece with the train in motion, and the solid line shows the use of the open ear-piece, with the train in motion.

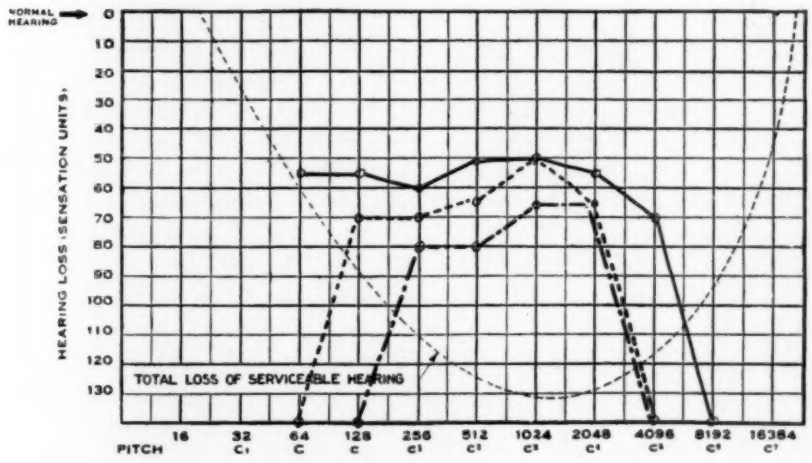

Chart 4.—Test of person with advanced otosclerosis using both ear-pieces. The solid line shows the effect of the closed ear-piece while the train was in motion and at the station. The line of equal dashes represents the open ear-piece with the train in the station, and the line of long and short dashes shows the use of the open ear-piece with the train in motion.

2. A defect in hearing which is the result of stapes fixation is not improved in the presence of extraneous sounds. The differences noted showed rather an increase in the defect.

3. Comparison of chart 3 with charts 2 and 4 will show that a person with normal hearing who uses the open ear-piece while riding on the train suffers a defect in hearing for the audiometer fully as great in the lower and middle tone ranges as that of the person with advanced deafness which is the result of otosclerosis.

4. The symptom of paracusis Willisi is not produced because the deafened person hears better in noisy surroundings, but is dependent on the increased difficulty of hearing which the person with normal hearing experiences in the presence of a noise. The increased difficulty in hearing for all tones, including the voice, which the normal person experiences in the presence of noise results in an effort, more or less unconscious, to raise his voice sufficiently to overcome this handicap. The person who is deaf because of fixation does not experience an increased handicap in the presence of extraneous sounds, since his deafness for the low tones effectually shuts out most of these extraneous noises. In noisy surroundings, therefore, the actual handicap experienced from obstructive deafness may even be less than that experienced by the normal person, because of the confusion created by extraneous sounds. This explains why a deafened person will often hear the voice better than one with normal hearing, for example, while riding on the train.

CHOANAL ATRESIA AND SINUS INFECTION *

W. E. GROVE, M.D.
MILWAUKEE

Choanal atresia is a condition consisting of a closure of one or both posterior nares by a complete or incomplete membranous, osseous or membrano-osseous partition. It is usually of congenital origin, although some authors doubt this. It is certain that in those cases which are not congenital the lesion must be the result of some severe chronic infection near the posterior nares, which results in subsequent formation of a cicatrix. The latter cases cannot be classified as true choanal atresias.

The total number of reported cases of this interesting condition is still so small that the further report of such cases is desirable. In 1923, Lebensohn [1] had collected 170 cases, which included one of his own. The total number of cases reported up to the present time probably does not exceed 180.

Lebensohn found that the occlusion was of the osseous type in 90 per cent of the cases. Schaffer [2] expressed the belief that congenital atresia of the choana is the result of the organization of epithelial plugs, which occasionally block the choanae early in fetal life, but that osseous tissue rarely develops in the organization. In a case reported by Charousek,[3] the occluding plate consisted of two layers of compact tissue, brittle as glass, between which there was a vascular spongiosa. Thomasson [4] regarded the atresia as due to an extension of the plate of the vomer, which becomes adherent to the outer nasal wall. Various authors speak of an indentation, grooving or furrowing of the posterior surface, which can be seen from the nasopharynx. Several authors, including Lebensohn,[1] call attention to the fact that the occluding plate is not placed at the extreme posterior portion of the vomer, but from about 1 to 2 mm. anterior to it.

The pathologic changes in the nasal fossae are manifold. In Nager's [5] case, the nasal fossa contained much mucus, and the inferior turbinate was covered by a mucous membrane of papillomatous appearance. Thomasson [4] reports a case in which the inferior turbinate appeared to be entirely absent and the middle turbinate small, of peculiar shape

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* Read before the Milwaukee Oto-Ophthalmic Society, April 19, 1927.

1. Lebensohn, J. W.: Ann. Otol. Rhin. & Laryng. **32**:1128, 1923.

2. Schaeffer, J. Parsons: The Nose, Paranasal Sinuses, Nasolacrimal Passageways, and Alfactory Organs in Man, Philadelphia, P. Blakiston's Son & Company, 1917.

3. Charousek, G.: Arch. f. Ohren- Nasen- u. Kehlkopf. **110**:209, 1922.

4. Thomasson: Laryngoscope **25**:221, 1915.

5. Nager, T. R.: Cor. Bl. f. Schweizr. Aerzte **45**:1339, 1915.

and placed lower than usual. White's [6] patient showed a polypoid degeneration of almost the entire mucosa. Kirby [7] particularly noted the anemic appearance of the turbinates. He states that the only other condition in which the turbinates have the same appearance is in tuberculosis of these structures. In Charousek's [3] case, the middle turbinate of the atresic side passed directly into the occluding bony plate as though the two were cast in the same mold. Lebensohn [1] speaks of the advanced degree of mulberry degeneration, the mucosa being anemic. He also calls attention to the undeveloped condition of the turbinates of the affected side. Vogel [8] noted that the turbinates are not only poorly developed, but also are shorter than normal anteroposteriorly. He calls attention to the papillary degeneration of the mucosa. In one of his cases, he noted that both middle and inferior turbinates were joined to the occluding plate.

A number of authors, particularly Vogel,[8] have drawn attention to the congenital changes of the face and adjacent structures associated with choanal atresia. In the case of Thomasson [4] the condition was associated with a congenital collaboma of the iris. Binnerts [9] reports the case of an infant, aged 3 months, in whom he found a double tragus on each side. Lebonsohn [1] and Lewy [10] reported cases associated with bifid uvulae. In Srebrny's [11] case of double atresia there was a double congenital aural fistula. Vogel [8] reported a case in which the ala on the side of the atresia was smaller than its fellow, and lateral to it was found the opening of a blind fistula. The upper dental arch was flatter on the affected side, and the raphe of the palate was inclined toward this side. Vogel [8] reported two cases; in one there was a rudimentary preauricular fistula on the same side, and in both, increased secretion of sweat on the same side.

Braun and Clasen [12] have shown that a certain amount of air change takes place in the sinuses during respiration. These volumetric changes are not in direct ratio to the amount of the inspired or expired air, but depend much more on the force of each individual inspiration or expiration. These air changes in the sinuses must necessarily greatly enhance the action of the ciliated mucous membrane of the sinus in promoting adequate drainage. The free ventilation of the nose is one of the most potent factors in the prevention of sinus disease and in the cure of an early existing sinus infection. As no air current is possible through a

6. White, L. E.: Laryngoscope **28**:571, 1918; Boston M. & S. J. **180**:153, 1919.
7. Kirby, J. C.: Laryngoscope **31**:701, 1921.
8. Vogel, K.: Ztschr. f. Hals- Nasen- u. Ohrenh. **11**:121, 1925.
9. Binnerts: Arch. f. Laryngol. u. Rhinol. **34**:324, 1921.
10. Lewy, cited by K. Vogel: Ztschr. f. Hals- Nasen- u. Ohrenh. **11**:121, 1925.
11. Srebrny, cited by K. Vogel: Ztschr. f. Hals- Nasen- u. Ohrenh. **11**: 121, 1925.
12. Braun and Clasen, cited in Skillern: Accessory Sinuses of the Nose, Philadelphia, J. B. Lippincott Company, 1913.

nose the posterior end of which is blocked, it must become apparent that the sinuses on the side of a choanal atresia are particularly susceptible to infection. McNaught [13] spoke of an involved antrum in one of his cases. Dean [14] said, "In cases of congenital atresia that have come under my care, all the children have suffered from paranasal sinus disease." Winslow [15] must have recognized the danger of sinus infection in these cases, for he advised operation as early in life as possible to avoid secondary changes in the facial structures or complications in adjacent structures. That more cases of sinus disease associated with choanal atresia have not been reported is, I believe, due to faulty examination—many of these cases occur in children—and careless notation of the observations in each case. It is difficult for me to see how the sinuses can escape infection in a condition of this character.

CASE REPORT

History.—Miss C. B., aged 48, white, complained of inability to breathe through the right nostril since birth and the constant presence of a thick, tenacious discharge in this nostril, which was hard to get rid of. The patient had never been able to blow the right side of the nose. She had had frequent sore throats, numerous headaches, general in character, during the past year and had been troubled with tinnitus for the past few months.

Examination.—Both tympanic membranes showed retraction and some thickening. There was no injection of the handle of the hammer nor of Shrapnell's membrane. The patient could hear a watch tick at a distance of 30 inches and the whispered voice at 20 feet, with each ear. The tonsils were of the buried type. The pillars were injected and the upper crypts of both tonsils contained liquid pus. The lower strait of the right side of the nose was almost completely filled with a heavy, thick, tenacious mucus. The patient was unable to expel this by blowing. On the right side, both the middle and inferior turbinates were atrophied and covered with a pale, degenerated mucous membrane with mulberry hypertrophies along the free edges of the turbinates. Posterior rhinoscopy showed the right choana completely closed, and a sound passed through the nose struck on a bony obstruction at the region of the posterior nares. Transillumination was indefinite. A roentgenogram showed both antrums and ethmoid regions blurred. There were no anomalies or irregularities of the face. The raphe was in the midline. Elevation of the right side of the hard palate could not be noted.

Operation and Course.—Nov. 3, 1924: Under general anesthesia, a Luc-Caldwell operation was performed on the right antrum, which was found to be filled with a heavy mucoid secretion. The sinus was packed and the pack was removed on the following day.

November 4: Irrigation of the right antrum showed only a few mucous shreds.

December 6: Under local anesthesia, a broad opening was made through the occluded choana of the right side with chisels and biting forceps. Then with a forward biting forceps the posterior portion of the vomer was removed. The edges of the wound were smoothed with curets. The nose was packed with gauze packing.

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13. McNaught, H. Y.: California State J. Med. **16**:193, 1918.

14. Dean, L. W.: Paranasal Sinus Disease in Infants and Young Children, J. A. M. A. **85**:317 (Aug. 1) 1925.

15. Winslow, J. R.: Maryland M. J. **58**:295, 1915.

December 7: The packing was removed from the right side.

Jan. 31, 1925: Some polypoid tissue was removed from the free edge of the right inferior turbinate; the antrum washing was clear.

August 8: Nine months after the operation on the choanal atresia a good sized opening persisted. There was no pus or mucus in the right side of the nose. Transillumination showed both antrums to be clear. The patient could blow her nose easily on both sides, and said that she felt much improved. The buzzing in her ears still persisted, but was not as noticeable as formerly. She was able to hear the watch at a distance of 40 inches with each ear.

NOTE.—The operation on the atresia should undoubtedly have been done first in this case, for thus the operation on the antrum might possibly have been avoided.

TREATMENT

Treatment is always operative, preferably as early in life as possible, as secondary changes in the facial structures or complications in the adjacent sinuses are thereby avoided, as Winslow [15] pointed out. According to Kirby,[7] it is more advantageous to operate on children because of the thinness of the occluding plate or membrane, the disadvantages being the limited space for operation and the oblique angle at which the choanal openings are placed.

The operation consists essentially in chiseling through the occlusion, with a subsequent smoothing of the free edges. The majority of authors favor the removal of the posterior portion of the vomer, but Jaques [16] expressed the belief that a simple resection of the fibro-osseous membrane without sacrificing any of the septum is sufficient if the patient is capable of carrying out through a period of several months a daily course of catheter treatment. Loeb,[17] in his textbook, said "Some authors remove the bony occlusion through a sub-mucous resection, but there is no advantage in this procedure, and the difficulties of the operation are greatly increased." I cannot coincide with Loeb's opinion in this matter. I believe the chances of maintaining an appreciable opening after operation are greatly enhanced by the removal of the posterior portion of the vomer. Bourgeois and Poyet [18] called attention to an interesting method of treatment. They remove the primary obstruction by means of chisels or burrs and then allow the secondary closure by cicatrix to take place, after which they destroy the secondary membrane by means of electrocoagulation. They have treated several patients in this manner, with excellent results.

The after-care varies according to the operator. Binnerts [9] inserted a 5 mm. drainage tube and leaves it in place for two weeks. Most operators content themselves with simple cleansing procedures. Brady [19] instituted a rather unique method of after-treatment, and one which has

16. Jaques, P.: Rev. de laryngol. **29**:607, 1921.
17. Loeb, H.: Operative Surgery of Nose, Throat and Ear, St. Louis, C. V. Mosby Company, 1917, vol. 2, p. 116.
18. Bourgeois and Poyet: Acta oto-laryng. **7**:568, 1925.
19. Brady, A. J.: J. Laryngol. Rhinol & Otol. **33**:49, 1918.

a great deal to recommend it. He passed a folded strip of bismuth gauze, ¾ inch (1.9 cm.) wide, through one nostril. This was caught in the nasopharynx by a dressing forceps passed through the opposite side of the nose and was drawn forward through this side. The two ends were then tied around the columella. This knot was untied daily by a nurse, who sewed a fresh strip of bismuth gauze to one of the free ends; the fresh gauze was then pulled through the nose and tied as before.

The after-treatment in my case consisted merely of cleansing procedures, and at the end of nine months a large opening persisted. It is interesting to note that at this time all signs of sinus infection had disappeared from both sides of the nose, which I attribute, not to the operation on the antrum, but to the better ventilation produced on both sides of the nose by the opening of the choana. I now believe that the operation on the right antrum could have been avoided had the choanal operation been done first. The sinus infection in this case was undoubtedly due to the poor ventilation of the nose.

120 East Wisconsin Avenue.

TUBERCULOSIS OF THE MIDDLE EAR*

FRANK R. SPENCER, M.D.
BOULDER, COLO.

Tuberculosis of the middle ear and mastoid is more frequent in adults than is generally recognized on account of the difficulty of finding tubercle bacilli in the purulent discharge. In infants and young children the disease extends to nearly all parts of the temporal bone and, because of this, is more serious than in adults. For those who practice in the West, the disease assumes relatively even more importance, because of the number of tuberculous patients who annually come West in search of health.

Judging from a study of the literature, tuberculosis of the middle ear rarely receives the serious consideration that such an important disease deserves. The milder types are easily overlooked, unless the etiology of all cases of suppurative otitis media can be thoroughly studied by a competent bacteriologist. The absence of pain often results in a late examination by an otologist, because patients do not seek relief early, and the presence of mixed secondary organisms from the external auditory meatus obscures the primary organism.

The frequency of tuberculous otitis media in patients suffering with pulmonary tuberculosis was recognized as early as the middle of the last century by Toynbee [1] and von Troltsch.[2] Wilde [3] had commented on the painless onset of tuberculosis of the middle ear, followed by discharge, and the peculiar appearance of the membrana tympani thirty years before the discovery of the tubercle bacillus by Koch, in 1882. Eschle [4] found tubercle bacilli in the discharge from the middle ear in 1883, and Habermann [5] first demonstrated giant cells and tubercle bacilli in the tympanic mucous membrane.

Politzer,[6] in 1865, described the clinical characteristics of tuberculosis of the middle ear. Later, he [7] made an examination of the microscopic changes of the middle ear and published a description of his observations in 1882. Schwartze [8] described very small tubercles in the mucous membrane in 1878.

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* Read at a meeting of the American Otological Society, New York, May 20 and 21, 1927.

1. Toynbee: Diseases of the Ear, 1860.
2. Von Troltsch: Arch. f. Ohrenh., vol. 2, 1862.
3. Wilde: Aural Surgery, 1853.
4. Eschle: Deutsche med. Wchnschr., 1883.
5. Habermann: Arch. f. Ohrenh., 1886.
6. Politzer: Beleuchtungebilder des Trommelfels, 1865, p. 65.
7. Politzer: Lehrbuch der Ohrenheikunde, ed. 1, p. 467, 1865.
8. Schwartze: Pathologische Anatomie des Ohres, 1878.

Mathews [9] said, "There are numerous considerations which combine to render tuberculosis of the middle ear and temporal bone a subject of great interest and importance, both clinically and pathologically. The number and variety of the channels through which infection may take place, the frequency of the condition, its occurrence in infants, the gravity of the condition and of its possible complications, the multiplicity and diversity of its signs and symptoms, the urgent necessity for drastic treatment, the possibility of absolute diagnosis and ultimate cure are the most important of these considerations."

The typical history of the appearance of discharge without previous pain is emphasized by most authors. Mathews [9] said, "The absence of pain is not peculiar to this condition, but is found in tuberculous osteomyelitis of any bone prior to the involvement of surrounding structures or the advent of mixed infection." Tuberculosis of the middle ear and mastoid shows, therefore, no exception to the general rule of absence of pain.

Mathews [9] also said, "The occurrence of discharge from the ear is not infrequently—in the absence of pain—the earliest symptom noticed. This discharge presents many points apart from its mere chronicity, and the absence of associated pain, which may justly raise suspicion that the case is tuberculous."

The history of pulmonary tuberculosis often makes the examiner suspect tuberculosis of the middle ear and mastoid. The presence of pain in the middle ear preceding the discharge is nearly always due to mixed infection, and the amount of pain is in proportion, to some extent at least, to the preponderance of the pus-producing organisms. Robinson's [10] patient had tinnitus before the drum ruptured, but no pain. Leegaard [11] expressed the belief that the pain is nearly always present preceding the discharge, but perhaps his patients had a mixed infection.

Briggs [12] expressed the opinion that the tubercle bacilli gain entrance to the middle ear in the following ways:

1. Through the eustachian tube, either by air or by particles of mucous blown through.
2. Along the eustachian tube by other than mechanical means.
3. Through the blood stream.
4. Through the lymphatics.

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9. Mathews, P.: Tuberculosis of the Middle Ear in Children, with Special Reference to Its Occurrence as a Primary Lesion, Ann. Otol., Rhinol. & Laryngol. **16**:390, 1907.

10. Robinson, J. A.: Tubercular Otitis, Ann. Otol., Rhinol. & Laryngol. **24**:363, 1915.

11. Leegaard, Frithjof: Tuberculosis of the Middle Ear, Laryngoscope **31**:374 (June) 1921.

12. Briggs, H. H.: Tuberculosis of the Middle Ear, Ann. Otol., Rhinol. & Laryngol. **23**:529, 1914.

5. By way of the external auditory meatus.

6. By extension of an intracranial infection through the internal auditory canal, fallopian canal or the labyrinth. The last is mentioned by Briggs merely as a possibility. Graham,[13] in commenting on this, said, "It is interesting to note that Habermann [14] has since described such a case."

In children, the pathologic change is usually more extensive, with rapid breaking down of all the tissues of the middle ear and mastoid or even of the entire temporal bone. The disease is often acute, while in adults the pathologic change is more frequently limited to the middle ear and is more uniformly chronic from the first. Infiltration, ulceration and necrosis are easiest to see antemortem in the membrana tympani, but at postmortem all parts of the middle ear may, from time to time, in different patients show tubercles. The granulation tissue is pale and flabby as compared to the red and firmer granulation tissue of pyogenic infection. Caries of the ossicula is common. Necrosis exposes the facial nerve, with subsequent paralysis; this occurs frequently in children and less frequently in adults. Different authors give widely different percentages of paralysis, but a fair average is 30 per cent. Leegaard [11] believed that paralysis of the facial nerve occurs in from 19 to 65 per cent of the cases. Milligan [15] found facial paralysis in 45 per cent of his series of tuberculous cases and in only 2 per cent of his nontuberculous cases. However, Lake [16] encountered facial paralysis in four of 658 consecutive cases of suppurative disease of the middle ear. Grunert [17] stated that facial paralysis is almost pathognomonic of tuberculosis of the middle ear and mastoid. This is not in accord with my own experience, because it is known that frequently there is a dehiscence of the bony covering of the facial nerve which enables any inflammation of the middle ear and mastoid to extend readily to the facial nerve and to produce a paralysis. This dehiscence is rare in adults, but is usually found in infants and young children.

Extension to the blood vessels followed by hemorrhage is as frequent in the middle ear as in the lungs, but, because of the small size of the vessels and the slight hemorrhage resulting, this often goes unnoticed. Glandular involvement is more frequent and more extensive in children than in adults. Retropharyngeal abscess has been attributed to tuberculosis of the middle ear.

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13. Graham, H. B.: Tuberculosis of the Middle Ear, Ann. Otol., Rhinol. & Laryngol. **25**:105, 1913.

14. Habermann: Ztschr. f. Ohrenh. **71**:288, 1915.

15. Milligan: Tr. Otol. Soc. United Kingdom, **4**:62, 1910.

16. Lake: J. Laryngol., May, 1895.

17. Grunert: München. med. Wchnschr., 1899.

Examination usually reveals seropus, mucopus or even thick pus in the external auditory meatus. After this has been removed, small multiple perforations are often found, if the examination has been made early in the course of the disease. Occasionally a patient complains of a full or stuffy feeling in the ear, and multiple caseating tubercles are found before perforations have taken place. Dr. George L. Tobey, in his graduate course at the meeting of the American Academy of Ophthalmology and Otolaryngology in September 1926, said that he had frequently found multiple perforations resulting from syphilis. Most authors writing on tuberculosis emphasize this feature of tuberculous otitis media. As the perforations increase in size, they coalesce to form larger perforations and eventually one large, or even one very large, perforation. The severity of the disease, the length of time it has lasted and the presence of mixed infection are all determining factors. Levy [18] said, "The majority of suppurative processes in the middle ear occurring in tuberculous patients do not go on to destruction of bone; therefore, surgical measures have but limited usefulness."

Granulation tissue may be scanty or abundant, but it is usually pale and flabby. Acute exacerbations of the disease and hemorrhages may for a time produce red granulations and more pus. Gaudier [19] regarded the presence of profuse granulations as a suspicious sign.

Deafness may be limited to a full feeling with loss of the low notes, or it may be total from destruction of the cochlea and static labyrinth.

Mastoiditis is frequent in children and is relatively infrequent in adults. Some adults with incipient pulmonary tuberculosis go for months or years without having mastoiditis. However, an acute infection of the respiratory tract, such as influenza, will often produce an acute exacerbation of the otitis media with extension to the mastoid. Intracranial complications may produce a rapidly fatal termination. In my own experience, meningitis has been the most frequent of the intracranial complications and has usually been discovered in patients with pulmonary tuberculosis.

The diagnosis can often be made from the appearances found at the examination with the aid of the history of absence of pain preceding the discharge, the history of pulmonary tuberculosis when present, or of tuberculosis elsewhere in the body. However, the examination should be supplemented by a bacteriologic examination of the pus. Tubercle bacilli are not easily found. Pus aspirated from the middle ear after all the free pus has been wiped away may contain a few bacilli. If this method of obtaining bacilli fails, an animal inoculation may prove the

18. Levy, R.: Surgical Treatment of Tuberculosis of the Upper Air Passages and Ear, Ann. Otol., Rhinol. & Laryngol. **15**:585, 1906.

19. Gaudier: Ann. d. mal. de l'oreille, June, 1899.

true etiology, but animals often die early from the mixed infection. Haskin [20] recommends the use of Petroff's media, which was the original media used by Doctor Dwyer at the Manhattan Eye and Ear Hospital, and advises that it be used with Miller's later media, made from the spleen and lymphatic glands of animals. It is easy to get a growth in from ten to twenty days. Haskin [20] also advises the use of antiformin before staining.

Thorough general physical examination, urinalysis, roentgen-ray examinations, serologic tests, etc., are all useful and are especially so for the purpose of excluding syphilis. Tuberculosis and syphilis are not infrequently found as dual infections. In adults a thorough physical examination of the chest, aided by stereoscopic roentgenograms, is necessary; and in children a general physical examination will usually find tuberculosis of the cervical lymph glands.

When Dr. I. S. Fraser of Edinburgh was an honor guest of the American Otological Society in 1923, at Atlantic City, he said that tuberculosis of the middle ear and mastoid is frequent in the children of Scotland, because the Scotch dairy herds are not tested for bovine tuberculosis, with the result that many infants and children have bovine tuberculosis of the middle ear, mastoid and cervical lymph glands.

Ravenel [21] said, "Laboratory investigations have shown beyond question that bovine tuberculosis is transmissible to human beings and that the lesions produced do not differ in any way from those caused by human bacilli."

Long [22] has reported tuberculosis of the middle ear and mastoid in an infant of 11 months; the condition was cured by a radical mastoid operation. Graham [13] has recorded tuberculosis of the middle ear and cervical lymph glands in an infant, with a fatal termination from a general tuberculosis, at 72 days of age. Horne [23] expressed the belief that the early glandular involvement is the result of primary tuberculous disease of the middle ear and is rarely found in secondary involvement.

The prognosis in adults with incipient pulmonary tuberculosis is usually good. With extensive pulmonary tuberculosis, disease of the middle ear only adds to the seriousness of the situation. In infants and young children, the disease of the middle ear and mastoid is more likely to prove fatal. Meningitis is more frequently a fatal terminal disease in infants and children than in adults.

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20. Haskin, W. H.: Conservative Treatment of the Chronic Suppurative Ear, Tr. Am. Otol. Soc., 1924, p. 601.

21. Ravenel, P.: Transmission of Bovine Tuberculosis to Human Beings, correspondence in J. A. M. A. **53**:2115 (Dec. 18) 1909.

22. Long, C. H.: Primary Tuberculosis of the Middle Ear, Laryngoscope **23**:700, 1913.

23. Horne, Jobson: J. Laryngol., March, 1903.

Treatment consists of cleansing the ear as often as the amount of discharge requires and then using some mild antiseptic, such as 10 per cent phenol in glycerin, 2 per cent mercurochrome-220 soluble, etc.

Heliotherapy offers the best method of conservative treatment and is easy to use. The sun may be allowed to shine into the middle ear through a speculum of metal or of glazed white paper. Recently, at the Mid-Western Section Meeting of the American Laryngological, Rhinological and Otological Society, Dr. S. J. Chapman showed pictures of a solar auriscope for reflecting the actinic rays into the ear. This also enables the patient to see his ear during the treatment. Exposures of one-half minute daily the first week are best; these are gradually increased each week until the treatments last from ten to twenty minutes daily.

Sequestrums of necrotic bone in children and infants require surgical removal as often as they form. The tuberculous glands may also require removal. Crockett [24] was in favor of removing both the tuberculous glands and bony sequestrums as often as seems best in the judgment of the otologist, until a cure has been accomplished.

REPORT OF CASE

One illustrative case may be of interest:

Mr. A., aged 26, a school teacher, came to Colorado with pulmonary tuberculosis in the fall of 1911. He had lost 20 pounds (9 Kg.); the left upper lobe and right apex contained scattered tubercles; he had a temperature of 99+, cough and expectoration, and occasionally a few tubercle bacilli were found in the sputum.

In February, 1912, he had an acute attack of influenza followed by slight pain in the left ear. The pain was so mild that he ignored it until he discovered pus in the left external auditory meatus on February 18, 1912. He consulted me on the 21st, complaining of a stuffy feeling, but the pain had ceased. After wiping away a small amount of pus, I found two small perforations in the membrana tympani; these were followed, during the subsequent few weeks, by others until there was one large perforation. Repeated bacteriologic examinations were positive for staphylococci, but were negative for tubercle bacilli. Finally, after a thorough cleansing of the canal, an aural aspirator was used to obtain pus for an animal inoculation. At the end of six weeks the bacteriologist reported, by telephone, that postmortem examination had showed the animal to be positive for tuberculosis.

Treatment consisted in cleansing the ear with applicators wound with cotton as often as the pus formed, and allowing the sun's rays to reach the membrana tympani through an aural speculum almost daily for many months. He made a good recovery in a year or two from pulmonary tuberculosis. His left ear gradually became dry. Applications of 33⅓ per cent trichloracetic acid to the margins of the perforation once a month finally resulted in a large depressed cicatrix over the inner wall of the middle ear. His hearing was poor for the lower register. Fortunately, the right ear had always been normal.

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24. Crockett, E. A.: Tuberculosis of the Middle Ear and Mastoid, J. A. M. A. **47**:1293 (Oct. 20) 1906.

CONCLUSION

I want to emphasize the importance of heliotherapy in accomplishing an ultimate cure of the suppurative middle ear. While the ear in this case is far from perfect, the patient is leading a useful life as a teacher in a public school. The pulmonary and aural tuberculosis are cured.

Physicians' Building.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

THE PARANASAL CAVITIES

A REVIEW OF THE LITERATURE OF 1925—1926

D. CAMPBELL SMYTH, M.D.
BOSTON

The literature on paranasal cavities during the past two years comprises between three and four hundred articles. Most of these deal with subjects on which much had already been written, and consequently they contain nothing essentially new. On the other hand, there is a paucity of writings on the subjects about which much should be written. For example, osteomyelitis of the cranial bones, of which increased knowledge of the etiology and treatment is of the utmost importance. Other subjects about which there is still much to learn are the physiology, anatomy, pathology and bacteriology of these regions.

I have attempted to cover most of the literature, giving summaries of the articles which contain something new, and also abstracting from many other articles, which, although they did not contain essentially new points, served their purpose as they emphasized strongly important facts.

ANATOMY AND EMBRYOLOGY

Neivert [1] reported the results of his anatomic observations in a series of 220 sets of sinuses, with special emphasis on the unusual factors, together with some applications and interpretations of clinical interest. He first took up the sphenoid and noted the great variation at the sphenoidal recess into which the sinus drains; sometimes it is almost obliterated. The size of the ostium varies greatly from that of a pinpoint to a condition of almost complete absence of the nasal surface of the anterior wall. It is practically always membranous, the bony circumference being much larger than its actual orifice. The optic nerve in 75 per cent of the cases caused the roof of the sinus to stand out in relief with pockets on either side. There were twelve specimens with dehiscences so located as to expose the nerve. Many of the sphenoids had recesses, diverticula and septums In sixteen specimens the sinus was found to extend into the median plane so far as to pneumatize the

1. Neivert, H.: Morphologic Variations As a Factor in Symptomatology of Paranasal Sinus Disease, Arch. Otolaryng. **1**:367 (April) 1925.

rostrum, and in thirteen cases it entered the septum proper. There was marked extension into the pterygoid in eleven specimens. In several specimens the sinus extended laterally to come into intimate relation with the ophthalmic, maxillary and mandibular regions. The vidian nerve was frequently found occupying a position above the floor of the sinus, and in several cases it was exposed. Two specimens showed a dehiscence between the right and the left sinus, and one of these had a dehiscence between the anterior projection and the maxillary sinus. Neivert endeavored to link up symptomotology and pathology with the anatomic condition. In regard to the ethmoid cells he emphasized the frequency of the ethmofrontal extensions, the intimate relation of some of the posterior cells to the optic nerve and the large number of cells overlying the orbit. He brought out an important point in the variations he found in the course of the anterior and posterior ethmodial vessels. These vessels were frequently found to go from the orbit mesially through the labyrinth and floor of the frontal sinus, lying either in the mucosa or bony partitions and rarely running free through the sinus covered by a dural prolongation. Then, instead of entering the anterior cranial fossa and going mesially through the foramina of the cribriform and to the nasal chambers they remained entirely intranasal. He inferred that this type of morphology adds to the possibility of involvement of the vessels by suppurative processes and extension through the cavernous sinus. Eleven specimens showed fusion of the caudal end of the uncinate and bulla, closing off the posterior end of the infundibulum into a pouch. In such cases any secretion from the frontal sinus would drain directly into the maxillary sinus. In regard to the maxillary antrum he noted particularly the irregularity of the contour of the sinus and the frequent presence of septums. He stressed the influence of the uncinate processes and the ethmoidal infundibulum which at times interfered with the drainage of these sinuses. Of the frontal sinuses, 30.5 per cent drained into the ethmoidal infundibulum and 67.1 per cent into the frontal recess. In four specimens, that is 2.4 per cent, the frontal sinus had developed from a bullous cell. He pointed out the impossibility of probing such sinuses. One sinus was so extensive that it excavated the superior and middle concha, and its ostium was in the lateral wall of the superior concha close to its attachment. Several sinuses excavated the nasal bones and the frontal processes of the maxilla and a large number had marked horizontal extensions coming into close relationship to the orbital contents. He claimed that vacuum headaches have a definite morphologic basis, verifying Sleuder's work in this connection. Several specimens showed two frontal sinuses on one side with separate ostia, the posterior one being in the horizontal plane. Probing of the sinus was especially difficult in many specimens of the series. This was due to the numerous ostia of infundibular cells. There were few deviations of the septum which would require an operation. The article

needs to be read to be appreciated, and I am pleased that the author has promised a more detailed report at some future date.

Van Gilse [2] reported a case in which the sphenoid sinus apparently was absent; however, close examination revealed that the orifice (and consequently the sinus itself) seemed to be lacking on account of the exceptionally low location, but that it came into being in consequence of a secondary constriction (at first membranous in character) of the passage between the main cavity of the nose and the anlage of the sphenoid sinus (sinus copularis posterior), the osseous antrum wall of the latter being formed mainly by ossification starting down the lower osseous nucleus of Bertin's concha. The orifice may be of higher or lower location, and in some cases it is duplicated.

Watson-Williams [3] reported an anatomically irregular sphenoid with coexisting optic neuritis.

Van Gilse [4] has published another paper on the development of the sphenoidal sinus. He stated that the sinus consists of two parts, the neosinus and the part situated directly behind the anterior wall, which the author names the palaiosinus. The palaiosinus develops early in fetal life. The nose is formed by an ingrowth of epithelium from the surface into the mesenchyme, and the resulting cavity becomes connected with the mouth through the primitive chonae. The extension of the ingrowth beyond the posterior part of the primitive chonae is the origin of the palaiosinus. In a 50 mm. embryo the nasal cavity is enclosed in a cartilaginous capsule, the posterior part of which becomes the sinus copularis posterior or recessus. At a further stage the recessus ossifies, forming a bony capsule which surrounds the sinus on all sides. On the anterior wall of the recessus a narrow opening remains which becomes the ostium of the later formed sphenoid sinus. Pneumatization begins only after the capsule and sphenoid have become fused. In adult life the sphenoid always consists of two parts, namely, the remains of the capsule and the true sinus. The pneumatization is performed by the subepithelial layer of mucous membrane covering the wall of the palaiosinus. When secondary pneumatization is incomplete, a sinus within a sinus may be formed. This is situated so laterally that it may be mistaken for an ethmoidal cell. Absence of the sinus is rare, and a double sinus can occur only with malformation of the nose. Double opening in a sinus is due to some pathologic condition. Cessation of pneumatization is due to the presence of softer material, such as remains of cartilage or connective tissue.

Thacker-Neville [5] reported two cases of anatomic abnormalities of the antrum; both patients were operated on.

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2. Van Gilse, P. H. G.: J. Laryngol. Rhinol. & Otol. **41**:137, 1926.
3. Watson-Williams, P.: Lancet **2**:858, 1925.
4. Van Gilse, P. H. G.: Acta. oto-laryng. **7**:192, 1925.
5. Thacker-Neville, W. S.: China M. J. **39**:296, 1925.

Radoievitch [6] examined the frontal sinus of sixty skulls, in which the most notable observation was the extreme variability of their capacity. He divided them into medium, large and small sinuses. Some of the smaller ones were so stunted as to be no larger in dimension than a grain of maize. He found small sinuses in 5 per cent of his cases. The frontal sinus was absent in only one case. The following were some of his observations:

Medium sized sinuses are the most frequent and are in the form of a triangular prism.

A well developed frontal sinus has four walls. Contrary to the general opinion, the prominence of the nasal lump and of the superciliary arches has no constant connection with the development of the sinus. A posterior supplementary wall may exist in place of the posterior angle, without an accesory cavity behind it.

Small sinuses of stunted development are seen at times so reduced in size as to present the dimensions of a grain of maize. The frequency of these small sinuses is estimated differently by various authors.

Besides these small sinuses one may observe sinuses in which the development may be in one of their prolongments.

Many authors have noted the absence of one or both frontal sinuses, but the frequency is diversely interpreted. There was only one case in the author's series. In this case, both the frontal and sphenoid sinuses were missing.

The author has not seen a patient with multiple frontal sinuses, but several writers have reported them. However, it is not rare to find behind the normal frontal sinus a supplementary cell developed between the two bony tables of the horizontal portion of the frontal sinus. Some attain such volume that they surpass the size of the frontal sinus. About 6 or 7 per cent of the patients have this supplementary frontal sinus. It is a purely supra-orbital sinus and seems to be merely an ethmoidal cell lateralized and abnormally developed in an arch of the orbit. The author terms it a supra-orbital-ethmoid-frontal sinus. Situated as they are between the ethmoid cells and the frontal sinus they often play an important rôle in inflammation of these parts. In diagnosing frontal sinusitis it is important to look for this supplementary sinus and to curet it. If the posterior angle of the frontal sinus is transformed into a more or less high vertical wall, but clear, one can almost surely diagnose the presence of a supplementary sinus behind the principal one.

Three cases of multiple sphenoidal sinuses have been reported by Caliceti.[7] They reach their complete development at the age of from about 20 to 25, and are of variable dimensions. Small and medium sinuses are not of much interest, but the large ones are. There are various prolongations which the author describes, as:

(*a*) The anterior prolongation occupies the root of the smaller wing and the base of the anterior clinoid processes. There may be also another offshoot around the optic canal.

(*b*) The palatine process is at the anterior inferior corner of the sinus and lies on the roof of the pterygopalatine fossa.

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6. Radoievitch, S.: J. de méd. de Bordeaux **55**:110, 1925.
7. Caliceti, Pietro: Ann. di. laringol., May, vol. 25, no. 3.

(*c*) The pterygoid cavity extends into the roof of the pterygoid and may extend into the lower wing.

(*d*) A posterior prolongation may reach back as far as the pons-variolii or even to the margin of the foramen magnum.

Besides these variations, some skulls have more than two sinuses, and three cases are recorded to show the different arrangements.

1. In the first case, there were two normal sinuses of fair size, and lying immediately above them in the upper portion of the body of the sphenoid were two other sinuses of smaller size. The latter were completely shut off from the inferior ones and opened by separate ostia into the nasal cavity. They lay in close relation to the optic chiasm and optic tracts.

2. The second type showed the two usual sinuses with a single sinus lying immediately above them and in front of the sella turcica. This sinus lay in close relation to the optic canal and its contents. It opened into the spheno-ethmoidal recess just above that part of the left inferior sphenoidal sinus.

3. In the third case there were two large anterior sinuses which opened normally and behind them, and separated by a complete bony septum, were two other large sphenoidal sinuses. These were separated from one another by a continuation of the septum between the two anterior sinuses. They lay below and behind the sella turcica, and no sign of an orifice could be found. The author considers that the multiplicity of the sinuses and their varying sizes may be due to the varying amount of resistance to the ingrowing processes from the nasal cavity presented by the sphenoid bone. The clinical importance of recognizing the fact that there may be more than two sinuses is great.

PATHOLOGY

McMahon [8] came to the following conclusions based on a study of seventy cases of spheno-ethmoidal sinusitis.

1. The following microscopic changes were found in connection with hyperplastic spheno-ethmoidal sinusitis:

Epithelium—Thickening, sloughing, polypoid degeneration, metaplasia.

Basement Membrane—Thickening.

Periosteum—Thickened.

Tunica Propria—Edema, round cell infiltration, fibrosis, dilatation or compression of glands, thickening of blood vessel walls.

Bone—Osteoplastic activity, osteoclastic activity, fibrosis, hyperostosis, osteomalacia and necrosis.

2. The following symptoms may be associated with the foregoing changes: headache, anteronasal discharge, postnasal discharge, asthma,

8. McMahon, B. J.: Pathology of Spheno-ethmoidal Sinusitis, Arch. Otolaryng. **4**:310 (Oct.) 1926.

arthritis, failing vision, impaired hearing and herpes of second division of the fifth nerve.

3. There is no direct interrelation of individual microscopic observations, symptoms and results of operation.

4. The incidence of spheno-ethmoidal sinusitis is much greater among women than among men.

5. The percentage of good results is much higher among women than among men.

6. Chronic hyperplastic spheno-ethmoiditis is a distinct clinical entity in which the operative results are attended with a high percentage of improvement or complete cure.

PHYSIOLOGY AND HISTOLOGY

Phillips,[9] after taking up the anatomy of the mucous membranes of the nose, discussed the results of Yates on the activity of ciliary epithelium within the sinuses. The author used dogs in his experiments. The frontal sinuses were laid open, and in one sinus a minute quantity of India ink was placed on the floor. The ink was backed up by the cilia and moved for a short distance up the posterior wall toward the roof of the sinus. It then turned at right angles and was propelled forward and downward toward the nasofrontal duct, through which it finally disappeared. In forty-five minutes the stain had moved toward the duct, and in two hours it had disappeared from the sinus. The nasofrontal duct on the opposite sinus was plugged with bone wax, and a larger quantity of ink was introduced. The sinus was then closed. When it was opened again in three days practically the same amount of ink remained as was placed there. The applications of cocaine 5 per cent to the sinus membrane retarded the action of the cilia for approximately thirty-five minutes, after which time the sinus was freed of the solution as before. Next, one frontal was curetted, and the other was used as a control. The stain was applied to both, and after two days it was still seen in the curetted sinus, although the frontal duct was open. The other sinus was free from it. It was the author's purpose to ascertain the time required for the ciliated epithelium to regenerate, if at all, after curettage, but he was unable to keep the animals alive long enough for this to take place. He now produced an acute frontal sinusitis by introducing nonhemolytic streptococcus. This condition was allowed to persist for two days. The sinus was then cleaned by washing with saline solution, and again the ink was applied. There was ciliary action, but it was sluggish and delayed. After the sinusitis subsided the ciliary action became more active. From his observation the author was

9. Phillips, F. L.: Ann. Otol. Rhin. & Laryng. **35**:709 (Sept.) 1926.

convinced that a healthy ciliated epithelium is a most important factor in maintaining a normal sinus condition, and that treatment should be directed toward reestablishing this healthy condition in as short a time as possible.

Another article on the embryology, anatomy and physiology of the antrum and sphenoidal sinuses was published by LeJeune.[10]

BENIGN TUMORS

The usual number of osteomas and mucoceles has been reported. Goodyear [11] cited a case of an osteoma, in which an area of the dura of about the size of one-half dollar was exposed; the operation was performed under local anesthesia.

Mucoceles of the frontal sinus were reported by Fox,[12] Gipner,[13] Bacher [14] and Daily.[15]

Klionsky [16] reported an unusual myxoma of the frontal sinus, with displacement of the eyeball.

MALIGNANT TUMORS

New [17] reported ninety-seven cases of malignant tumors of the antrum in which the patients were treated by cautery and radium. He claims to have eliminated operative deaths to a great extent. Of the 186 patients that came under his observation, 129 had primary tumors of the antrum and 39 had tumors secondary to tumors of the upper jaw. He reviewed the literature, and then gave his method of selection of his cases for treatment, considering first the age of the patient, second, the extent of the tumor, third, previous treatment and, fourth, duration of the disease. He laid great stress on the grading of epitheliomas by Broders in determining the treatment, also the prognosis. For example, a patient with an extensive squamous cell epithelioma grade II of the antrum might be beyond all chance of cure with the use of the cautery or diathermy, whereas a patient with a squamous cell epithelioma of the same size grade IV with no metastasis might have a reasonable chance of being cured by the direct application of radium to the tumor. In the lower grade of malignant tumors including the mixed ones, one must depend on the cautery or diathermy almost entirely, whereas in the higher grade epitheliomas and sarcomas the results depend largely on radium rather

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10 LeJeune, F. E.: Laryngoscope **36**:889 (Dec.) 1926.
11. Goodyear, H. M.: Cincinnati M. J. **6**:31, 1925.
12. Fox, M. C.: Northwest Med. **25**:30, 1926.
13. Gipner, J. F.: Surg. Clin. N. Am. **5**:881, 1925.
14. Bacher: San. Fran. **23**:1444, 1925.
15. Daily, L.: Ann. Otol. Rhin. & Laryng. **35**:834, 1926.
16. Klionsky, G.: Lancet **1**:126, 1925.
17. New, G. B.: Malignant Tumors of the Antrum of Highmore, Arch. Otolaryng. **4**:201 (Sept.) 1926.

than the cautery. His patients selected for treatment were those who appeared to have a reasonable chance of being cured. The untreated patients were those in whom the condition was too far advanced for any form of effective treatment. Ether anesthesia was used in the earlier cases, but during the last few years block anesthesia with nitrous oxide was given as required. He has not used preliminary ligation of the external carotid as a routine measure. New aimed to destroy the whole tumor with one treatment, and at the time of operation the radium is inserted into the cavity. The author noted favorable results from the use of this line of treatment.

A case of carcinoma of the maxillary antrum of twenty years' duration is cited by Kilgore and Chamberlain.[18]

Arno Saxen [19] suggested a morphologic classification of the tumors of the nasal and maxillary cavity, stating that an agreement has not yet been reached concerning the histologic classification of endothelial carcinomas and papillomas and those growths arising in the accessory nasal sinuses, because, in the first place, in general pathology different points of view have been taken concerning the basis of classification of epithelial tumors, and secondly, because the special tumors in this region have not been subjected to exhaustive anatomic study owing to the difficulty of obtaining a sufficient uniform supply of hospital material. The classification he suggested is as follows:

1. Carcinoma kerakonosum.
2. Carcinoma basocellulare.
3. Carcinoma cylindocellulare.
4. Carcinoma medullare.
5. Carcinoma papillomosum.

Klestadt and Martenstein [20] reported fifty-eight cases of malignancy of the sinuses. Forty-nine of the patients had carcinoma and nine had sarcoma. Their method of treatment consisted of the most radical removal of the tumor, avoiding unnecessary mutilation. A radical operation was performed on all the patients whose sinuses were diseased. Following the operation the roentgen ray or radium, or a combination of both, was employed. Of the forty-eight patients discharged after operation, four have not developed any recurrence or metastasis during the period of five years. The authors emphasize the importance of the postoperative roentgen-ray treatment, but they do not believe that the latter can take the place of a radical operation.

Quick,[21] as the result of his experiment, made the following conclusions:

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18. Kilgore, A. R., and Chamberlain, W. E.: S. Clin. N. Am. **6**:513, 1926.
19. Saxén, Arno: Acta. oto-laryng., 1925, vol. 7, part 1.
20. Klestadt, W., and Martenstein: Beitr. z. klin. Chir. **133**:626, 1925.
21. Quick, D.: Surg. Gynec. Obst. **42**:462 (April) 1926.

1. Surgical exploration of the paranasal sinus and biopsy should be resorted to earlier and more frequently so that the early diagnosis of new growth may be made.

2. With few exceptions, the principles applying to surgical removal of cancer in general cannot be carried out in dealing with growths of the paranasal sinuses.

3. Radium and the roentgen ray are of value in treating this group of patients, but except in palliative cases they must be used in conjunction with surgery.

4. Radium and the roentgen ray may be depended on to eradicate the tumor tissue if applied accurately and uniformly throughout the growth in sufficient dosage.

5. Surgical procedure must be employed to provide exposure for applications of radium and adequate drainage.

6. The anatomic relations of the parts are such that infection is a greater menace here than in new growths in most other locations.

Saxén [22] reported sixty-one patients with papilloma or carcinoma of the nose and sinuses. He made a study of these patients from the pathologic, anatomic and clinical standpoint. Of ten cases of papilloma, two showed signs of beginning malignancy. The precancerous conditions noted were papillomas, common polypi, metaplastic or embryonal broken off epithelium and others. He condemned the endonasal treatment of papillomas, advised more radical operation in those cases followed by after-treatment with radium and said that while the prognosis for papilloma is rather good, it is not encouraging in carcinoma. Nineteen of his patients were operated on; ten of the operations were supramaxillary resections. In these latter cases 32 per cent of the patients died of pneumonia; the other operated on had either a Caldwell-Luc or a Moure operation, and lived from two to three years. Only one of his patients was free from relapse after five years. In the twenty-six patients not operated on, the average duration of the disease was fourteen months. But if this author's results are not encouraging, later statistics of Holgreu, Hofer and others are better. They use diathermy, followed by radium and roentgen-ray treatments.

FRONTAL SINUS

A great deal has been written the past two years on the frontal sinus. In the literature, however, there is comparatively little that is new, most of the publications on the subject dealing with reports of cases.

Nasiell [23] described the technic of an intranasal operation, a modification of Halles. One is surprised to learn that he gets excellent results in spite of the fact that he uses burrs in the region of the nasofrontal duct.

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22. Saxén, A.: Finska läk.-sällsk. handl. **67**:1064, 1925.
23. Nasiell, Wilhelm: Acta. oto-laryngol., 1925, vol. 7, part 1.

Bárány [24] described a modified Killian operation. He opened the sinus from above and below and endeavored to cover the partly removed nasofrontal process with a flap of mucous membrane from the sinus. He claimed that granulation tissue and stenosis are avoided by this method.

Gumperz [25] also endeavored to use a flap of mucous membrane in the region mentioned. The author's method of approach to the frontal sinus is through an incision in the alveolar process such as is used in the Denker operation. After elevating the soft tissues he does what he calls a submucous resection of the frontal process of the upper jaw. The mucous membrane of the middle nasal meatus is used to form a flap which is laid in place on the lateral or anterior wall of the sinus and is fixed with a loose tampon.

Stauffer [26] concluded from his own experience and as a result of a questionnaire that the external operation is the method of choice in chronic suppurative sinusitis. He said that the choice of this operation is influenced by the size and shape of the sinus, the extensive shallow sinuses being more effectively treated by the Killian method. The deep anteroposterior sinuses with septums respond to the Ogsden-Luc technic, and the Knapp-Bárány-Lynch method is successful and least disfiguring in all other sinuses.

Campeggiani [27] reported two cases of anomalies of the frontal sinus, complete absence of the sinus in one and in the other excessive development of the sinus.

Dampier-Bennett [28] wrote in considerable detail on a case of chronic sinusitis in which he claimed that symptoms were relieved and cure effected by a new method of ionization. He has had only this one case but considered it worth publishing because the result was so striking.

An interesting case of echinococcus cyst of the frontal sinus has been reported by Citelli.[29] He stated that the only case reported previously was recorded by Davaime-Traite in 1877. The author's patient was a child, aged 11. There was a deviation of the right eye, with marked exophthalmos and sensitiveness on pressure but almost no spontaneous pain. The cyst was preceded by a cyst of the liver. An Ogsden-Luc operation was performed and the sinus was found to be filled with a mass, whitish on the outside and yellowish white on the inside. The case resulted in a cure without deformity. The diagnosis was confirmed by microscopic examination.

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24. Bárány, R.: Acta. oto-laryngol. 1925, vol. 7, part 1.
25. Gumperz, R.: Ztschr. f. Hals-, Nasen-u. Ohrenh. **9**:291, 1924.
26. Stauffer, F.: Ann. Otol. Rhin. & Laryng. **34**:1206, 1925.
27. Campeggiani, M.: Valsalva, **1**:95, 1925.
28. Dampier-Bennett, A. G.: Practitioner **115**:285, 1925.
29. Citelli: Rev. de laryngol. **46**:236, 1925.

Other articles on the frontal sinus have been published by MacKenzie,[30] Lodge,[31] Howard,[32] Gaudet,[33] Datta [34] and Roberts.[35]

SPHENOID SINUS

A new contribution to the technic of operation on the sinus has been made by Sewall.[36] Using local anesthesia, he approaches the ethmoidal region by the external route, first ligating the anterior ethmoidal artery, proceeding backward and then ligating the posterior ethmoidal, if necessary. This gives him the advantage of a bloodless field in which to study and work on the ethmoidal cells. Proceeding backward, he next ligates the sphenopalatine, if there is work to be done on the sphenoid sinus. Special and ingenious instruments are used for ligating these arteries. He and his assistant have performed the operation thirty times with no fatality or untoward results. In all cases the frontal sinus was opened and in many it was found to be diseased. Considerable bleeding occurred in two patients when the skin incision was made, but bleeding from the work on the sinus was practically absent. The average time taken for the operation was one and one-half hours.

Bertemes [37] cited a case of right chronic otorrhea of fourteen years' duration, somewhat fungous with fetid pus, occipitomastoid pain and wry neck. Pus was seen in the sphenoid ostium in the same side. After the sphenoid condition was cleared up, the pain and the torticollis disappeared. Five months later some of the pain returned because of sphenoid retention. When this was cleared up, the pain immediately disappeared. The author calls attention to the possible error of diagnosing such a case as chronic mastoiditis.

Lupo [38] reported a case of enchondroma of the sphenoid sinus having an oculohypophysial syndrome. His patient was a woman, aged 23, who had been healthy up to the time of onset, when menstruation suddenly ceased. Two months later, the patient had convulsions with simultaneous disturbances of consciousness; at the same time she had severe headaches, especially in the right temporal region, drowsiness was present and increasing for a year, and acuteness of vision diminished until she was completely blind. Descending atrophy of the optic nerves was present on both sides, and also bilateral exophthalmos which the author attributed to pressure of the tumor on the cavernous sinus. The patient had also multiple enchondromas of the hands and feet.

30. MacKenzie, G. W.: Am. J. Syph. **9**:479, 1925.
31. Lodge, W. O.: Brit. M. J. **1**:607, 1926.
32. Howard, L. G.: J. Iowa M. Soc., **15**:637, 1925.
33. Gaudet, L. S.: New Orleans M. & S. J. **78**:152, 1925.
34. Datta, J. K.: Calcutta M. J. **20**:49, 1925.
35. Roberts, S. E.: Ann. Otol. Rhin. & Laryng. **33**:735, 1924.
36. Sewall, E. C.: Tr. Am. Laryng. Ass., 1926, p. 196.
37. Bertemes: Ann. d. mal. de l'oreille, du larynx **44**:1260, 1925.
38. Lupo, M.: Riv. oto-neuro-oftal. **2**:152, 1925.

Caliceti [39] called attention to this same syndrome and reported an observation in which the Citelli syndrome was caused by sphenoid lesions. Citelli described the special syndrome which is frequently encountered in patients with adenoids characterized by a diminution of memory, drowsiness or insomnia, a slight mental deficiency and difficulty in fixing the attention. He ascribed it to hypophysial disturbances because of the seat of the lesions and the anatomic relations between the nasopharynx and the hypophysial system. Caliceti claims that while the sphenoidal etiology is rare compared with the pharyngeal etiology for this syndrome, that it does exist and that the same anatomic reasons explain it. A biologic argument cited by Citelli and Caliceti in favor of hypophysial disturbances is that in a number of their cases hypophysial infections produced reactions in temperature and disturbances in general health, these disturbances not being produced in healthy persons.

ETHMOIDAL SINUSES

A case of syphilitic ethmoiditis in an infant was reported by Bisi.[40] The parents both had syphilis. Polypi could be seen almost at the alae six days after the child's birth. The author says that the polypi were already started in the groove of the ethmoid before birth and grew so large that on the sixth day they were already visible in the nasal vestibule.

Another case of ethmoiditis in an infant was reported by Salerno,[41] his patient being 3 months old. In this case the Wassermann reaction was negative.

A paper on hemorrhage following ethmoidectomy was published by Kulkin.[42] He reviewed the literature on the subject for the past few years and reported a case of his own

A most unusual case was reported by Skillern.[43] During an operation on the ethmoids he found what evidently was a dehiscence in the posterior wall of the sphenoid. Through this a probe was passed for over seven inches (17.78 cm.). A roentgenogram taken with the probe in place showed the end of it to be well within the cranial cavity. Although the operation was performed under local anesthesia, the passing of the probe did not bother the patient. He recovered and left the hospital. A little over two months later he returned complaining of a severe headache and said that he had been well until the day before. He had a slow pulse rate, rapidly became comatose and died early in the morning of the next day. Autopsy showed that death occurred from

39. Caliceti: Rev. de laryng. **46**:13, 1925.
40. Bisi, H.: Rev. Asoc. Méd argent Soc de Otorrinolaringol. **1**:45, 1925.
41. Salerno, J. J.: Laryngoscope **35**:52, 1925.
42. Kulkin, S.: Laryngoscope **35**:27, 1925; ibid. **35**:36, 1925.
43. Skillern, S. R.: Ann. Otol. Rhin. & Laryng. **35**:71, 1926.

a cerebral hemorrhage, and although the sinuses were infected, a dehiscence or hole could not be found leading from them into the cranial cavity.

Pratt [44] made a plea for saving the middle turbinate, from an anatomic standpoint. He said that the olfactory nerves entering the nasal cavity through the cribriform plate are distributed over the whole middle turbinate. The olfactory sheaths are therefore opened during an ethmoidal operation in which the turbinate is removed, and infection is apt to travel along these sheaths into the cranial cavity, resulting in meningitis.

A critical consideration of intranasal and external methods of operating on the ethmoid has been written by Skillern.[45] He believes that as a primary operation the external method would not be deliberately chosen, but that it has its place only with these indications:

1. When repeated intranasal procedures have failed.
2. When there are indications of, or actual rupture externally.
3. When there are orbital or cerebral complications.

In cases showing the first or second indications, the operation is almost always on the frontal sinus including the ethmoid rather than on the ethmoid alone. This leaves one absolute indication for an external operation on the ethmoid. Skillern was not inclined to depend too much on the roentgen ray in this region, and doubted if he had ever seen a chronic case in which the entire ethmoid was the primary seat of chronic suppuration, except in the atrophic type, in which operative procedure seems to be contraindicated, as it only aggravates the infective process. In his practice he said that every fatality following operation on frontal sinuses has shown atrophic processes in the ethmoidal region. In cases without absolute indication for the external operation, he said that he has not had any difference in the results. Should the external route be decided on the operation should be performed with the idea of exenterating the entire capsule, from the foremost cell to the sphenoid area, and from the fovea ethmoidalis to the lamina papyracea. "Unless this is done we shall find ourselves in the same predicament as if we had done an incomplete internal operation except that in addition we shall have burned our bridges behind us."

In an attempt to save the middle turbinate, as advocated by Pratt, Horgan [46] advocated a transantral method of exenteration of the ethmoid cells. He first performed a Caldwell-Luc operation and then approached his ethmoidal labyrinth from the antrum posteriorly, curet-

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44. Pratt, John A.: Present Status of Intranasal Ethmoid Operation, Arch. Otolaryng. **1**:42 (Jan.) 1925.

45. Skillern, R. H.: Ann. Otol. Rhin. & Laryng. **34**:1077, 1925; Tr. Sect. Laryng. Otol. & Rhin. 98, 1925.

46. Horgan, J. B.: J. Laryng. & Otol. **41**:510, 1926.

ting all the cells and coming as far forward as the frontal process of the maxilla. If the middle turbinate is not diseased or polypoid, it is left in position. Among the disadvantages of the operation he mentioned that it is tedious to perform and that partial stenosis of the lacrimal duct has occurred in a few cases. He considers this approach to the ethmoidal labyrinth, however, one of the safest, and, if done by a competent operator, one of the best methods of getting the best results.

Hunt [47] reported an accidental injury to the dura while performing an intranasal ethmoid operation under local anesthesia. Fortunately, his patient recovered.

Robinson and McCullagh [48] have reported their results of radium treatment in sixteen cases of polypoid ethmoiditis. Complete ethmoidectomies were performed in twelve cases, partial ethmoidectomies in two and no operation in one. Four of the patients had asthma. From their work they conclude that the intervals between recurrence of polypi were lengthened and that the amount of polypoid tissue formed was diminished. Asthma was relieved, and the associated purulent condition was benefited. The reader is left in doubt after reading this article, as to whether radium is of any real benefit in this condition.

Other articles on the ethmoid sinuses have been published by Heitger,[49] Sulzman,[50] Hume,[51] Walker [52] and McNaught.[53]

MAXILLARY SINUSES

Numerous papers have been published concerning the maxillary sinus. A great many of them, however, deal with ordinary medical and surgical treatment, concerning which much has been written in the past. Antrum disease and its relation to the teeth has been discussed in papers written by Brown,[54] Scott,[55] Gatewood [56] and Dunning.[57]

Brown reviewed the anatomic relations of the sinuses and teeth, quoting extensively from the literature, and emphasized rightly the difficulty of eradicating alveolar fistulae which have been made by curetting up through a tooth socket, a practice too common among dentists. At the conclusion of his article he was too kind to the oral surgeons when

47. Hunt, J. G.: Accidental Rupture of Ethmoid Roof with Subsequent Recovery, Arch. Otolaryng. **3**:452-453 (May) 1926.
48. Robinson, G. A., and McCullagh, S.: Radium in Polypoid Ethmoiditis, Arch. Otolaryng. **4**:215 (Sept.) 1926.
49. Heitger, J. D.: J. Indiana M. A. **19**:5, 1926.
50. Sulzman, F. M.: New York State J. Med. **30**:114, 1925.
51. Hume, J. R.: New Orleans M. & S. J. **78**:227, 1925.
52. Walker, J. R.: J. Oklahoma M. A. **18**:1, 1925.
53. McNaught, H. S.: Surg. Clin. N. Amer. **6**:571, 1927.
54. Brown, L. E.: Ann. Otol. Rhin. & Laryng. **34**:150, 1925.
55. Scott, R. L.: South African M. Record **23**:162, 1925.
56. Gatewood, E. T.: Virginia M. Monthly **51**:647, 1925.
57. Dunning, H. S.: Laryngoscope **35**:766, 1925.

he said, "There should be a more earnest and hearty cooperation between him and a rhinologist in order to obtain earlier and better results in maxillary sinus infections." A better wording of this conclusion would have been, when an oral surgeon recognizes an antrum infection, he should immediately call in a rhinologist to conduct the further treatment of the patient.

Mithoefer [58] reported his results on forty-eight cases of nonsuppurative maxillary sinusitis which he terms hyperplastic. A radical operation was performed in all cases. He gave four types of hyperplastic sinusitis:

1. Antrum hyperplasia with extension of numerous polypi into the nose, combined with suppuration (mixed form).
2. Antrum hyperplasia with extension of numerous polypi in the nose with absence of suppuration.
3. Hyperplasia in the antrum without extension of polypi into the nose, but with the presence of mild pathologic changes in the nasal mucous membranes and other sinuses.
4. Hyperplasia of the recesses of the antrum cavity.

He attributed the pathologic process in the latter to recurring acute inflammations. One is confused by his statement that polypi in the antrum may be diagnosed by feeling with a probe through the ostium, and also by his mention of the presence of a flapping sound of polypi against the antrum wall during lavage.

In a paper on the dangers of needle puncture of the antrum, Skillern [59] referred to the cases of sudden death reported in the literature, about ten in number. In all of these, there was at first great resistance, and a lot of pressure was required to force the irrigated fluid in. He raised the question which is obvious to all: "Was the needle really in the antral cavity, or was it buried in the swollen mucosa?" He said that he had never seen a patient who gave him any anxiety and believes that whenever there is undue resistance to the air, no attempt should be made to force it, but that the cause should be investigated. He also emphasized the so-called hyperplasia and its possible connection in some cases to Rose colds, vasomotor rhinitis and the like.

A case of empyema of the antrum, believed to be of scarlatinal origin, was reported by Dabney.[60] The patient did not have any other symptoms of scarlet fever, and there was nothing unusual about the case.

Ross [61] reported a case in which there was severe hemorrhage with a hematoma of the antrum following an ordinary needle puncture which did not bleed at the time of operation.

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58. Mithoefer, W.: Laryngoscope **36**:137, 1926.
59. Skillern, R. H.: Ann. Otol. Rhin. & Laryng. **35**:717, 1926.
60. Dabney, V.: Ann. Otol. Rhin. & Laryng. **34**:257, 1925.
61. Ross, M.: Laryngoscope **35**:600, 1925.

Olsho [62] and Dowling [63] have published papers on nonsurgical treatment of suppuration of the antrum. The former made claims for postural drainage; the latter stated that he depends on a nasal tampon soaked in mild silver protein and applied under the middle turbinate. Good results are claimed by both in the treatment of their patients.

Oertel [64] described his method of operating on the antrum, which consists in taking down the naso-antral wall underneath the lower turbinate, working through an incision made above the canine teeth. He turns the flap of mucous membrane from the naso-antral wall in to the antrum, a procedure which has been given up by most surgeons owing to the fact that this flap always sloughs away in time and only serves to keep up a prolonged nasal discharge.

Other articles on the maxillary sinus include those by Stauffer,[65] Thomas,[66] Perry,[67] Ruskin,[68] Maltz [69] and Qualls.[70]

ACCESSORY SINUSES IN GENERAL

Skillern,[71] in discussing headaches from a nasal aspect, said that the so-called vacuum or negative pressure in the sinuses is exaggerated as a cause. He believes the pain is due to pressure exerted on the nerve endings in the sinus mucous membrane, associated probably with a certain toxicity liberated by the infecting micro-organisms. Thus, there is both a mechanical and a toxic factor in the causation of headache. He emphasized that a characteristic of sinus headache is its intolerance to alcohol and tobacco and attributed this to the consequent increased congestion caused by these.

Spielberg [72] reported three cardiac cases in which maxillary sinusitis was also present. Treatment of the sinusitis resulted in great improvement, and consequently the cardiac condition was improved. He concluded that the sinuses were the foci for the condition of the heart.

Along this line Watson-Williams [73] also published an exhaustive article in which he stressed the mental aspect, citing cases ranging from neurasthenia to delusional insanity, due, he claimed, to toxemia from sinus infection.

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62. Olsho, S. L.: Laryngoscope **35**:259, 1925.
63. Dowling, J. I.: Laryngoscope **35**:453, 1925.
64. Oertel, T. E.: Ann. Otol. Rhin. & Laryng. **35**:866, 1926.
65. Stauffer, F.: Ann. Otol. Rhin. & Laryng. **35**:845, 1926.
66. Thomas, J. D.: U. S. Vet. Bur. M. Bull. **2**:693, 1926.
67. Perry, R. W.: Northwest Med. **24**:83, 1925
68. Ruskin, S. L.: Laryngoscope **36**:119, 1926.
69. Maltz, M.: Laryngoscope **35**:805, 1925.
70. Qualls, H. W.: New Orleans, M. & S. J. **78**:667, 1926.
71. Skillern, R. H.: Ann. Otol. Rhin. & Laryng. **34**:917, 1925.
72. Spielberg: M. J. & Record **123**:822, 1926.
73. Watson-Williams, P.: J. Laryng. & Otol. **40**:765, 1925.

Pern [74] has recorded his experience in the treatment of various diseases due to focal infection, and after setting out the same in a series of seven tables he proceeded as follows: "Having in the past experienced no satisfaction in my patients from operative treatment and having also found the use of vaccines unavailing, I looked for some other method in the hope of benefiting these patients."

He then started using colloidal manganese and found it almost a specific in sinusitis, clearing up the condition in two or three weeks, from four to eight injections being sufficient. He claimed to have used it in hundreds of cases with consistent good results, and said that it cures not only the focal infection but also the conditions resulting from the infection.

In an article on headache of nasal origin, Lille [75] made the point that it is usually possible to diagnose headache of this type and deprecated the fact that many intranasal operations are performed in migraine cases which are not of nasal origin.

Langier [76] cited cases in which a restoration of conditions in the accessory sinuses to approximately normal was followed by the subsidence of various heart, kidney or other disturbances, including asthma, headache or brain fag.

Shore [77] also reported a number of cases in which the focus of infection was in the maxillary sinus.

Among other articles that have appeared along this line of focal infection originating in the sinuses are those by Faulkner,[78] Clausen [79] and Skillern.[80]

The results of treatment with vaccines in fifty cases of sphenoethmoid disease have been published by Fenton.[81] He claimed that by using an autogenous vaccine from hemolytic streptococci to have obtained 73 per cent of cures, while in the nonhemolytic streptococcus, 30 per cent were cured by autogenous vaccines.

Sonnenschein [82] found that diphtheria bacilli not infrequently caused purulent inflammation of the accessory sinuses. A complete cure may be obtained by antitoxin, surgical treatment not being necessary.

Pilot and Lederer [83] reported two cases of ethmoiditis of a putrid character, and in each they found fusiform bacilli and spirochetes. These

74. Pern: M. J. Australia, May 9, 1925.
75. Lillie, H. I.: Surg. Gynec. Obst. **43**:111 (July) 1926.
76. Langier: San Juan. **18**:59, 1924.
77. Shore, F. E. V.: Laryngoscope **35**:917, 1925.
78. Faulkner, E. R.: Laryngoscope **35**:742, 1925.
79. Clausen, S. W.: Parenchymatous Nephritis; Infection of Paranasal Sinuses As Etiology, Am. J. Dis. Child. **29**:587 (May) 1925.
80. Skillern, R. H.: J. Indiana M. A. **18**:8, 1925.
81. Fenton, R. A.: Ann. Otol. Rhin. & Laryng. **34**:1051, 1925.
82. Sonnenschein, C.: Deutsche med. Wchnschr. **51**:1369, 1925.
83. Pilot, I., and Lederer, F. L.: Ann. Otol. Rhin. & Laryng. **34**:366, 1925.

organisms appeared identical with those obtained about normal teeth, tonsils and adenoids, and in the putrid processes of the mouth and lungs. In one patient the use of arsphenamine seemed to influence the infection.

FOREIGN BODIES IN THE ACCESSORY SINUS

Wilson [84] made a complete review of the literature on this subject to date. He divided the cases into five groups:

Group I: Foreign bodies of dental origin of which seventeen observers reported nineteen cases.

Group II: Calculi. Two observers reported two cases.

Group III: Instruments and appliances. Thirty-three observers reported thirty-five cases.

Group IV: Gun pieces and bullets. Forty observers reported forty-one cases.

Group V: Miscellaneous foreign bodies. Twelve observers reported thirteen cases.

Stress is laid on the value of the roentgen ray in the diagnosis and the fact that a foreign body may be tolerated in a sinus for years without suppuration. Facial neuralgic pains were almost the only symptoms in some cases.

Cook [85] reported a case of shrapnel in the antrum, without any dental involvement. The patient's symptoms were relieved by a radical operation on the sinus.

OCULAR COMPLICATIONS

The articles appearing during the past two years on ocular complications have been numerous, and it would be impossible to abstract and report them all. It is gratifying that the general trend of the writers on optic neuritis of toxic origin is to return gradually to the sound teachings of fifteen years ago. The wave of enthusiasm for operating on posterior ethmoid cells and sphenoids which do not show pathologic process clinically, or by roentgenograms, seems to be dying out.

An interesting discussion of this subject took place during the past year in the Royal Society of Medicine [86] between the section of ophthalmology and laryngology. The participants in this discussion were Turner, Mayou, Davis, Moore, Collins, Williams-Noble, Watson-Williams, Gibb, Davies, Traquair, Hord, Glegg and Whitehead. The consenus of opinion was that in estimating the beneficial effect on the vision of surgical intervention in the cavities of the nasal or posterior sinuses due regard must be paid to the fact that in cases of retrobulbar neuritis there is a tendency to spontaneous cure, and the operation may

84. Wilson, M. Bryed: Ann. Otol. Rhin. & Laryng. **35**:1259 (Dec.) 1926.
85. Cook, J. D.: U. S. Vet. Bur. M. Bull. **2**:392, 1926.
86. Royal Society of Medicine, J. Laryng. & Otol. **41**:321 (May) 1926.

be performed at a time when the vision is commencing to undergo natural resolution. The necessity of cleaning up obvious foci of infection in the teeth, tonsils or any other part of the body was emphasized. Undoubtedly, a certain number of cases of optic neuritis (a small percentage) tend to progress to optic atrophy. In these cases every effort should be made to prevent blindness, and in such cases any operative procedure seems justifiable.

Articles on this subject have been published by Whelan,[87] Miller,[88] Deichler,[89] Gottlieb,[90] Wright,[91] Honiss,[92] Lacy,[93] Tooker,[94] White,[95] Watson-Williams [96] and others.

Yerger [97] has analyzed 357 cases of empyema of the accessory nasal sinuses which were involved as follows: frontal, 45 per cent, maxillary, 28 per cent, ethmoidal, 24 per cent and sphenoid, 3 per cent. Of 150 cases of orbital phlegmon, 146 were recorded as orbital cellulitis and four as orbital abscess. He said that the most frequent cause of unilateral exophthalmos is suppurative sinusitis. The common orbital complication of sinusitis is orbital cellulitis or abscess. This is more common from the frontal sinus in adults and from the ethmoids in children. In his series there were thirty-seven cases of exophthalmos, or one of every four in his cases of orbital phlegmon, and one of every ten in his cases of nasal sinusitis. He gave a summary of seven cases of exophthalmos secondary to sinus diseases. Three were the result of acute and four of chronic sinusitis. Supra-orbital swelling was present in four cases; limitation of ocular movement in five cases and chemosis in two cases. Opthalmoscopic examination was negative in every case. Four patients recovered and three died, the complications being meningitis, extradural abscess and abscess of the brain. Drainage by the external route was advised.

Patterson [98] also reported five cases of sinusitis with orbital complications, exophthalmos being present in two instances. One patient died of meningitis two days after ethmoidectomy.

Jones [99] reported three cases of acute ethmoiditis in young adults, with rupture into the orbit. He believes that the inflammatory swelling

87. Whelan, G. L.: Laryngoscope **35**:430, 1925.
88. Miller, C. M.: Laryngoscope **35**:687, 1925.
89. Deichler, L. W.: Am. J. Ophth, **9**:346, 1926.
90. Gottlieb, M. J.: Am. J. Surg. **39**:166, 1925, Laryngoscope **35**:844, 1925.
91. Wright, R. E.: Brit. M. J. **1**:597, 1925.
92. Honiss, J. R.: Hahneman. Month. **60**:610, 1925.
93. Lacy, J. E.: U. S. Vet. Bur. M. Bull. **2**:393, 1926.
94. Tooker, C. W.: Am. J. Ophth. **8**:878, 1925.
95. White, Leon E.: Tr. Am. Laryng. Ass., p. 69, 1926.
96. Watson-Williams, P.: Bristol Med.-Chir. J. **42**:121, 1925.
97. Yerger, C. F.: Am. J. Ophth. **8**:882, 1925.
98. Patterson, J. A.: Ann. Otol. Rhin. & Laryng **34**:226, 1925.
99. Jones, A. C.: Ann. Otol. Rhin. & Laryng. **24**:860, 1925.

closing up the middle meatus causes the organism (staphylococcus in his cases) to be grown under anaerobic conditions. This will produce carbonic acid gas, causing great pressure, which finds its easiest outlet toward the orbit. The rupture into the orbit occurs more in childhood and young adults, because there is less fibrous connective tissue in the turbinate; this permits a more rapid and greater swelling of the turbinate and also makes it easier for the pus to break through toward the orbit or cranium. He believes that it is dangerous to temporize with any case of orbital swelling with ethmoid infection, and that prompt surgical relief should be given.

Cases of choroiditis, sympathetic opthalmia and bullous keratitis associated with sinus disease have been reported by Vaughn,[100] Key [101] and Griscom,[102] respectively.

Stibbe [103] cited a case of a supposedly healthy man who had a sharp pain in the eye after a sudden attack of sneezing. Inflammation in the orbit followed, and cure was effected by surgical treatment of a hitherto unsuspected process in the maxillary antrum on the same side.

Three cases of sphenoiditis diagnosed by tests for color acuity were reported by Brown.[104] The vision in all the cases was normal. He claimed that the test for color acuity is useful, because most of the diseases of the conducting paths and centers, as well as the diseases of the neuro-epithelium, can be studied long before symptoms are revealed, and many cases of blindness may be thus prevented. The simplicity of the test, he said, should commend it to medical examiners in schools, factories, industrial plants and other places.

Mezzatesta [105] reported nine cases of changes in the optic nerve. Two patients showed gummas of the sphenoidal sinus, and the remaining seven had tumors compressing the optic nerve in the region of the optic canal. One patient had an enchondroma of the sphenoid, one presented a fibro-endothelioma of the maxillary sinus, two had endotheliomas, one had a sarcoma and in two the condition was not classified.

INTRACRANIAL COMPLICATIONS

The possibility of the virus of epidemic encephalitis having its route through infections of the nasal sinus is strongly suggested in a paper by Yates,[106] and also in one by Yates and Barnes.[107] They recognized four types of inflammation.

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100. Vaughn, E. H.: Texas State J. Med. **21**:318, 1925.
101. Key, B. W.: Am. J. Ophth. **9**:574, 1926.
102. Griscom, J. M.: Atlantic M. J. **28**:740, 1925.
103. Stibbe, F. H.: Nederlandsch. Tijdschr. v. Geneesk. **1**:464, 1923.
104. Brown, M. E.: New Orleans M. & S. J. **78**:671, 1926.
105. Mezzatesta, F.: Riv. oto-neuro-oftal, January-February, 1925.
106. Yates, A. L.: J. Laryng. & Otol. **40**:646, 1925.
107. Yates, A. L., and Barnes, S.: Lancet **2**:130, 1925.

Type I: The secretion is clear mucus and the cilia either are active or are fatigued by the actual work necessary to remove the mucus.

Type II: This type is similar, but the inflammation is of a higher degree, and the secretion is mucopurulent.

Type III: In this type the mucus is fermented by the micro-organisms contained within it, so that it is thin and partially toxin-permeable, as a result of which bacterial toxins reach and cause congestion of the mucous membranes.

Type IV: The mucous membrane is pale, and the ciliary action is paralyzed. The mucous secretion is absent or represented by a thin whitish coagulum or by fluid material.

In an examination of twenty-three cases of encephalitis the authors found this last type of inflammation in or around the sphenoidal sinus in all. Seven of the patients gave a history of acute rhinitis following sinus pain, generally associated with some degree of ill health. In the patients who developed encephalitis after suffering from a chronic and intense rhinitis for some years, bacteriologic examination showed in almost all cases the presence of either Friedlander's bacillus or the pneumococcus, and the well recognized chronicity of the nasal infection when these organisms are present affords an explanation of type IV inflammation in these cases. They demonstrated the increased absorptive power of the mucous membranes in type IV sinusitis by injecting solutions of either indigocarmine or phenolsulphonphthalein into the sinus. It will appear in the urine, but it will not appear when injected into a sinus lined by relatively normal mucous membrane. The authors thus suggest that the infection in encephalitis is a symbiotic process, that in the first place the mucous membrane is damaged by one of the catarrhal groups of organisms and that subsequently the virus of encephalitis is inhaled, passes through the damaged mucous membrane and is absorbed into the brain by way of the perineural lymphatics.

Lobell [108] and Cowan [109] also each reported a case of sinusitis, one involving the ethmoid and the other the maxillary antrum coexisting with epidemic encephalitis, but they did not undertake to establish any relationship between the two.

Cases of abscess of the brain associated with disease of the accessory nasal sinus have been reported by Jesseman [110] and Parrish.[111]

Ide [112] cited a case of psychosis in which the patient apparently was cured by the clearing up of a coexisting chronic maxillary sinusitis.

A case of acute frontal sinusitis accompanied by cavernous sinus thrombosis, extradural abscess and subdural abscess was reported by Vanderhoof.[113]

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108. Lobell, A.: Laryngoscope **36**:505, 1926.
109. Cowan, H. A.: Lancet **2**:648, 1925.
110. Jesseman, L. W.: Boston M. & S. J. 739, 1925.
111. Parrish, R. E.: Laryngoscope **36**:336, 1926.
112. Ide, C.: Laryngoscope **35**:924, 1925.
113. Vanderhoof, D. A.: Ann. Otol. Rhin. & Laryng. **35**:508, 1926.

Fink [114] also reported a case of involvement of the posterior sinus in a syphilitic patient, with extensive intracranial involvement.

Gatewood [115] reported two cases of acute toxic encephalitis of nasal sinus origin. Both patients recovered following operations on the diseased sinus.

Lannois [116] described a syndrome noted on four occasions. It occasionally follows operative intervention within the nose, particularly on the middle turbinate and accessory sinuses. The syndrome consists of an ascending hemiplegia which develops with extreme rapidity in several hours, involving the upper limbs and eventually the face. In one case seen with Tixen, a semipurulent clot in the superior longitudinal sinus, with thrombosis of several smaller adjacent veins, was found at autopsy. Edema was present, with infiltration of the whole subjacent tissue of the brain, especially of the paracentral lobule and the two ascending rolandic convolutions. This ascending hemiplegia, however, is not absolutely pathognomonic of longitudinal sinus thrombosis. Lannois quoted a case which he saw with Molinie in which no clot was found in the sinus, but in which a large intradural abscess extended from the parietal region to the anterior pole of the cerebral hemisphere.

PARANASAL SINUS DISEASE IN CHILDREN

During the past two years a great deal has also been written on paranasal sinus disease in children. I am glad that the tendency seems to be toward more conservative treatment, so far as operating is concerned, on patients in this group. The consensus of opinion among most of the writers seems to be that paransal sinus disease in children is largely regional in this country and that climatic conditions play a great part. In the large clinics in the East, a comparatively slight amount of sinus trouble is seen in children. The writers on this subject do not always convince the reader that the diagnosis of sinusitis has been established beyond doubt. Some authors report cure by removal of the tonsils and adenoids in 80 per cent of cases of sinusitis in children, and then one will encounter another writer who considers sinusitis the reason for apparent failure to get results following operation on the tonsils and adenoids.

Barlow,[117] for example, said that many children are not cured of their recurrent head "colds" following operation on the tonsils and adenoids, because of an existing sinusitis. He claims that medical measures are of no avail in this disease, and that surgical drainage is the

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114. Fink, E. B.: Surg. Gynec. Obst. **41**:589, 1925.

115. Gatewood, E. T.: Acute Toxic Encephalitis of Nasal Sinus Origin, J. A. M. A. **84**:1473 (May 16) 1925.

116. Lannois, M. Lyons: Acta oto-laryng. 1925, vol. 7, part 2.

117. Barlow, R. A.: J. Michigan M. Soc. **24**:43, 1925.

rational procedure. This might be warranted if a true chronic sinusitis existed, but it does not seem justifiable to make a diagnosis of sinusitis because a child is below par and consequently susceptible to recurring nasal infections.

Dean [118] has continued his work on this subject and has not changed his views materially. Eighty per cent of his patients with a chronic condition have been cured by removal of the tonsils and adenoids. He regards sunlight and proper diet of great importance, and reserves operative intervention only for the most severe cases.'

A series of 145 cases has been reported by Mitchell.[119] The ethmoid was involved in all cases, and the antrum in eighty-four. The frontal and sphenoid sinuses were each involved in two cases; the maxillary in fifty-nine cases. Of these, thirty-seven were surgical cases and twenty-two were nonsurgical. Cultures showed the staphylococcus to be the predominating organism. In a few instances the staphylococcus was isolated in pure culture.

Krieger [120] gave his observations on 101 cases of nasal infection, inclusive of diphtheria in childhood. First reviewing the development of the sinus, he said that the maxillary sinus is evident about the seventieth day of fetal life. After the fifteenth year it may be considered as of an adult size. The frontal sinus appears from the age of 6 to 12 months. The sphenoid sinus is demonstrable about the fourth month of fetal life. The initial outpouchings of the ethmoids are in evidence as early as the fourth month of fetal life, and by the seventh month the invaginations have taken shape in the form of hollow, tubular-like, blindly ending sacs, with ostia in communication with the point of original outgrowth. The question of nasal infection is thus seen to be important, when the early development of the sinuses and their relation to the nasal mucous membranes and lymphatic supply is recognized. The author pointed out the reasons for taking care of the nasal infections before resorting to operation on the tonsils and adenoids. Frequently, the operation is rendered unnecessary by persistent nasal treatment. This is another side of the question, and the author illustrated his points by citing a number of case histories. Cough was a prominent symptom in twenty-one cases. Recovery was complete under nasal treatment. Fever was the predominant symptom in thirty-eight cases. Enlarged cervical glands occurred in eighteen cases; malnutrition in nine; ocular disturbances, mainly inflammations of the lids or conjunctiva and cornea in six, and asthma in nine. In the treatment the author used suction and applications of silver preparations.

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118. Dean.: Parnasal Sinus Disease in Infants and Young Children, J. A. M. A. **85**:317 (Aug. 1) 1925.

119. Mitchell, E. C.: South. M. J. **18**:686, 1925.

120. Krieger, W. A.: New York State J. Med. **25**:203, 1925.

Davis,[121] in his series of cases, found that the predominating organisms were pneumococci. He advised conservative treatment and has found mixed pneumococci vaccines to be of benefit.

Gittins [122] had three cases of orbital cellulitis in children, resulting from sinus disease. All the patients recovered, following intranasal drainage of sinuses.

Other articles on this subject include those by Shea,[123] Smith,[124] Spake,[125] Spielberg,[126] Huenekens,[127] Etheridge,[128] Braswell,[129] Moore,[130] Irwin,[131] Meyers [132] and Ravdin.[133]

ROENTGENOGRAPHY

The use of iodized oil as an aid in roentgengraphy of the sinuses has been advocated recently by several writers.

Dobrzanski and Leneratowski [134] experimented first with solutions of 5 per cent strong silver protein and 15 per cent potassium iodide, but the fluid nature of these detracted from their value. They next tried iodized oil (40 per cent) injecting from 4 to 6 cc. into the antrum by means of a cannula, with the patient lying on the diseased side. The nasal cavity was packed with paraffin immediately after the injection. In cases of suppurative sinusitis with polypi and thickened mucous membrane the shadow is smaller and irregular, with uneven outline. When a tumor fills the sinus cavity, little islands of opaque material can be discerned. Also, dental cysts can be injected from the alveolar fistula, and thus the relation to the maxillary cavity is clearly shown.

Proetz,[135] in an article on displacement irrigation of the nasal sinus, said that radio opaque oil is an aid in diagnosis. He is pursuing a further study of this subject at present.

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121. Davis, W. B.: Atlantic M. J. Aug. 1925.
122. Gittins, T. R.: Oto. Rhin. & Laryng. **34**:1259, 1925.
123. Shea, J. J.: End Results of Sinus Surgery in Children, Arch. Otolaryng. **2**:111 (Aug.) 1925.
124. Smith, C. H.: Arch. Pediat. **42**:227, 1925.
125. Spake, L. B.: J. Kansas M. Soc. **25**:397, 1925.
126. Spielberg, W.: Med. Times, **53**:304, 1925.
127. Huenekens, E. J.: Journal-Lancet **45**:568, 1925.
128. Etheridge, H. R.: Virginia M. Month. **42**:373, 1925.
129. Braswell, J. C.: J. Oklahoma M. A. **18**:2, 1925.
130. Moore, T. W.: West Virginia M. J. **20**:57, 1925.
131. Irwin, V. J., Jr.: Boston M. & S. J. **192**:217, 1925.
132. Meyers, L. W.: Journal-Lancet **45**:543, 1925.
133. Ravdin, B. D.: Cincinnati J. M. **6**:132, 1925.
134. Dobrzanski and Leneratowski: Ann. d. mal. de l'oreille, du larynx Oct. 1925.
135. Proetz, A. W.: Tonsils and Adenoids, Arch. Otolaryng. **3**:365 (July) 1926.

Goodyear [136] and Fraser [137] advocated the use of iodized oil as an aid in diagnosis; the former used it in a series of thirty-four sinuses, and the latter reported a study of thirty-five cases. While this procedure undoubtedly has its use in certain selected cases, it does not seem to be a necessary or a practical one to follow in all cases. Most expert roentgenologists would rather make a diagnosis of thickened lining, polypi, etc., from the flat plate appearance than rely on vacancies in the picture to make it.

Grier's [138] article on roentgenologic diagnosis of sinus disease is outstanding in the past two years and should be read by every otolaryngologist. The following is a quotation:

> There is probably no other branch of roentgenology that has passed through such a trying period in an effort to gain a little knowledge. The main reason for the difficulties which have been encountered and the mistakes which have been made has been a lack of knowledge of roentgenology on the part of the rhinologist and an utter ignorance of rhinology on the part of the roentgenologist. Up to the present, little attempt has been made to rectify this serious drawback. The rhinologist has apparently been content to relegate the X-Ray to a very minor place in sinus diagnosis; and the roentgenologist has a very confused idea as to just what the surgeon expects from him and how he can be of assistance. The whole situation needs to be very carefully gone into in an effort to find some common ground on which specialists in these two fields can meet. It seems improbable that the greatest good can be obtained either by the rhinologist reading his own plates, or by the roentgenologist attempting to make the diagnosis. In the first instance, a lack of knowledge of roentgenological findings in general and an experience limited to the practice of one individual, even if large, would seriously handicap a rhinologist acting as his own roentgenologist. In the second instance, the roentgenologist is more seriously handicapped than his confrère as a complete diagnosis can seldom, if ever, be made without the history, symptoms and physical findings. As an illustration of this point, I would call attention to the fact that an antrum filled with pus as the result of an acute infection, and perhaps present for a week or so looks no different on a roentgenogram than an old chronic empyema of the antrum which has possibly been present for years. However, from the standpoint of the rhinologist I assume that the differentiation must be quite important. If sinus roentgenology is ever to become the valuable adjunct in diagnosis which I believe is possible, the roentgenologist must have a better knowledge of sinus pathology and must understand more definitely from the rhinologist just what he expects to find out from the X-Ray examination. The rhinologist on his part can greatly aid the roentgenologist by giving him more operative findings so that he may gradually accumulate positive knowledge that certain definite X-Ray findings accompany specific pathology as demonstrated on the operating table.

Articles on technic have appeared by Granger,[139] Jerman [140] and Bryan,[141] all aiming at perfection in roentgenographic diagnosis.

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136. Goodyear, H. M.: Iodized Oil in Diagnosis of Nasal Sinus Conditions, Arch. Otolaryng. **4**:223 (Sept.) 1926.
137. Fraser, R. H.: J. Michigan M. Soc. **25**:270, 1926.
138. Grier, G. W.: Boston M. & S. J. **143**:50, 1925.
139. Granger, A.: Radiology **6**:23, 1926.
140. Jerman, E. C.: Radiology **7**:164, 1926.
141. Bryan, L.: Am. J. Roentgenol. **14**:57, 1925.

Other articles on the subject have been published by Wherry,[142] Briggs,[143] McKelvie [144] and Enfield.[145]

OSTEOMYELITIS OF SINUS ORIGIN

Osteomyelitis of sinus origin is, curiously, one of the subjects on which little has been written and which, in my opinion, deserves the greatest attention by otolaryngologists, as it is one of the most fatal of all the complications of operation on the sinus. In reading over the literature one is struck by the difference in mortality of osteomyelitis above and below the brow. Writers on osteomyelitis of the facial bones record a high percentage of cures, while those reporting cases in which the process is above the orbit have a correspondingly high mortality, regardless of what procedure is resorted to in combating the disease. There still are two schools when it comes to a discussion of treatment of this condition, that which advocates conservative treatment and that which advises radical surgical procedures.

Lillie [146] reported two cases which came under his observation. Both proved fatal, and both followed operation on the frontal sinus. Death in each case was due to intracranial extension. He advocated radical operation in dealing with the disease.

The same author [147] also reported four cases of periosteomyelitis of the superior maxillar following intranasal operation on the maxillary sinus. One patient died of meningitis, and the other three recovered. The treatment consisted of surgical drainage of the suppurative process. He favored McKenzie's classification of this disease; namely, (1) localized osteomyelitis which has no tendency to spread and heals after the primary disease is removed; (2) diffuse or spreading osteomyelitis which has a tendency to progress in spite of every procedure, and which occurs as two types—spontaneous, appearing to come from a sinus which was not operated on, and postoperative, occurring especially after operations on the frontal sinus. It might be questioned here whether in his classification the localized types are true cases of osteomyelitis or whether they are not simply cases of necrosing bone in which the blood supply has been shut off by vascular thrombosis, no infecting organism being present.

Certainly otolaryngologists have all seen these cases, have seen the patients recover and have been struck by the clinical picture they pre-

142. Wherry, W. P.: Value of Roentgen Ray in Rhinologic Diagnosis, with Elaboration of Oblique Method of Rhese, Arch. Otolaryng. **3**:1 (Jan.) 1926.

143. Briggs, H. H.: Ann. Otol. Rhin. & Laryng. **34**:485, 1925.

144. McKelvie, B.: British M. J. **2**:58, 1926.

145. Enfield, C. D.: Kentucky M. J. **23**:253, 1925.

146. Lillie, H. I.: Ann. Otol. Rhin. & Laryng. **34**:353, 1925.

147. Lillie,: Tr. Am. Laryng. Ass. 1926, p. 228.

sent, which is entirely different from the true diffuse spreading osteomyelitis. Again, as to the so-called spontaneous type, in practically all of these cases there is a history of trauma, and lastly, another point to be noted about this condition is that the mortality rate jumps by leaps and bounds if the process extends above the eyebrow.

Bulson [148] has reviewed and collected fifty-five cases of osteomyelitis of the frontal sinus from the American and foreign literature. Thirty-seven of these cases were fatal. Twenty-eight of the cases occurred as complications of chronic sinusitis. Operation was performed on all of the patients. There were sixteen deaths and eleven recoveries in the group. Three of the acute cases were what may be called spontaneous or fulminating, occurring coincidentally with the acute frontal sinusitis. All of the patients died. Bulson reported the case of a patient of his own who recovered following conservative surgical drainage while the osteomyelitis was in the acute stage. Notwithstanding this fact, he for some reason advocates radical surgical procedures. In his own case, the operation was performed two and one-half months after the onset of the disease, at a time when the diseased bone might have begun to separate spontaneously.

Frey [149] reported a case of so-called spontaneous osteomyelitis of the acute form, beginning in the anterior wall of the frontal sinus. This patient recovered under conservative operation. Foci were opened and drained as they developed, and three and one-half months after the first operation the final sequestrum, a large one, was thrown off.

Tawse's [150] patient also recovered following conservative treatment consisting of simple surgical drainage. The process in this patient was extensive, involving the entire frontal bone. He did not do any curetting or chiseling. The organism present was *Staphylococcus.*

Callfas [151] reported three cases with complicating abscess of the frontal lobe. Two patients completely recovered and the other evidently was recovering but had lost his vision at the time the article was written. In the two patients who recovered, the organism was *Staphylococcus.* The operation on the bone performed on these patients was moderately conservative. So far, the literature on this subject leaves one with the idea that the advocates of radical operation have not yet proved their point.

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148. Bulson, A. E., Jr.: Osteomyelitis of Frontal Bone as Complication of Frontal Sinusitis, J. A. M. A. **86**:246 (Jan. 23) 1926; Tr. Am. Acad. Ophth. **30**:102, 1925.

149. Frey, G.: J. Otol. & Laryng. 308, 1925.

150. Tawse, H. B.: Proc. Roy. Soc. Med. Sect. Laryngol. **18**:18, 1924.

151. Callfas, W. F.: Tr. Am. Laryn., Rhin. & Otolaryng. Soc., 1926, p. 434.

SINUSITIS AND SUPPURATION OF THE LUNG

Adams [152] reported four cases of chronic maxillary sinusitis with bronchiectasis as a coincident disease.

Raffo [153] published the report on eight cases of so-called bronchiectasis which he studied. He concluded that chronic sinusitis may be a factor in bronchitis and bronchiectasis and may occur, as Mullin says, through the lymph vascular system or by direct inhalation. He believes that some of his cases originated from overlooked sinusitis in childhood and also said that patients with bronchiectasis are benefited by treatment of the diseased sinuses.

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152. Adams, J.: J. Laryng. & Otol. **40**:172, 1925.

153. Raffo, E.: Concomitance of Sinusitus and Bronchiectasis, Arch. Otolaryng. **2**:557, 1925.

Abstracts from Current Literature

Ear

VERTIGO. F. LEIRI, Ztschr. f. Hals- Nasen-u. Ohrenh. **17**:392 (Feb. 22) 1927.

Leiri discusses the seeming movement of surrounding objects and of the body, as perceived by the eye and by the sense of touch. Uneasiness, nausea and sometimes vomiting accompany these sensations. The author investigated the exciting mechanisms and their biologic importance. The most frequent cause of the phenomena of vertigo is violent rotation, active or passive, like that of the otologic turning test. He states that optic vertigo appears when one moves so fast in relation to the surrounding space that one cannot fix visual impressions. The image of the surroundings moving swiftly on the retina causes dizziness.

The author made the following experiment with the motion of objects seen during vertigo caused by turning. After rapid rotation from left to right (ten rotations), he quickly sat in a chair about 3 meters in front of a high window. A slender vase, placed on the window sill so that the top was about on a level with the eye, appeared to move to the left, but the wall of a house, located at a distance of about 20 meters, moved simultaneously to the right, with a velocity which was much greater than that with which the vase appeared to move to the left. This seeming motion of near and distant objects in opposite directions occurs when looking with one eye while the other is covered. The phenomenon is explained by the difference of perception between the central and peripheral parts of the retina. With the aid of the foveal function, immovable objects or those moving with moderate velocity, as during the slow phase of nystagmus, are sharply seen. When objects are in motion, for instance, during fast movements of the eyes, foveal vision is lacking, but the peripheral parts of the retina come into play.

Concerning the apparent motion of the body after rotation, the author states that during the first negative phase of rotation (Fischer and Wodak), exactly the same reaction occurs, but in an opposite direction; namely, after rotation to the right, the same reaction set in as during rotation to the left. By means of objects which can be observed during and after turning, the seeming rotation of one's body may be explained. The hypotheses of Mack and Breuer, who think that conscious sensations of rotary movements are perceived through the semicircular canals, should be abandoned. When visual impressions are not present, perception takes place only through sensibility of the muscles. The vestibular function, however, is necessary for the development of vertigo. The vestibular apparatus elicits the involuntary unconscious contractions of muscles in the body, the effects of which are perceived as centrifugal force and inertia.

Vomiting or the prodromal stage, nausea, is a constant symptom in optic and vestibular vertigo. Optic vertigo is caused by the quick motion of the image of the surrounding space across the retina. This might occur naturally only during rapid circular motion; the greater the angular velocity, the more severe is the vertigo. In such motion all parts of the body are exposed to a centrifugal force. The pressure on the wall of the ventricle is increased, causing greater tension of the wall and sphincter pylori. The semicircular apparatus seems to elicit a tonus in the ventricle, which probably counteracts the effect of centrifugal force while one is turning. An irritation of the vestibular

apparatus similar to that observed in violent circular motion, occurs after the turning test, without the presence of centrifugal force and without an increased velocity of the masses in the ventricle, and the increased tonus of the wall of the ventricle and of the sphincter pylori leads to nausea and vomiting.

The advantage or necessity of reflexes in circulatory motion in order to raise the tonus of the wall of the ventricle is easily seen. If a person runs with a velocity of 5 meters a second and suddenly changes the direction, describing a curve with a radius of 1 meter, the value of the centrifugal force is 25 m/sec^2 (from the formula $c = \frac{v^2}{R}$ (C = centrifugal force, V = linear velocity, R = radius). The end-result, r, in relation to the gravity $g = 9.8$ and to the centrifugal force is obtained from the formula $r = \sqrt{c^2 + 9^2}$, in this instance 29.9 m/sec^2, a value about three times as great as that which gravity alone would furnish for the velocity of the masses. If a person moves with a velocity of 3 meters a second and suddenly changes the direction with a radius of 0.5 of a meter, the value from the increase of centrifugal force is 18 m/sec^2, and for the resulting velocity 20.5 m/sec^2.

WHAT DOES SUBOCCIPITAL PUNCTURE REVEAL IN OTOGENOUS MENINGITIS? EXPERIMENTAL STUDIES IN RABBITS. H. LOEBELL, Ztschr. f. Hals- Nasen-u. Ohrenh. **17**:443 (March 18) 1927.

Animal experimentation with rabbits led to the following conclusions.

1. Suboccipital puncture showed meningitis two and one-half hours after the introduction of microbes into the inner ear. It was diagnosed by examination of the cerebrospinal fluid.

2. By examining the fluid procured by suboccipital puncture at certain intervals, the course of the inflammation could be followed, with certain limitations.

3. The number of cells, reactions for albumin and color of the fluid agreed and allowed conclusions concerning the increase or decrease in the severity of the meningeal disease. They are accurate indicators.

The number of cells increased, polymorphonuclear leukocytes predominated, the albumin reaction became doubly and trebly positive, and the fluid became cloudy. These conditions were especially apparent in animals killed within the first twenty-four hours.

With the decrease of the number of cells, the increase in lymphocytes compared with leukocytes, the albumin content became less, and the color of the spinal fluid became clearer. This was proved by animals which had recovered clinically from meningitis and which had been observed for months.

4. Repeated suboccipital punctures at short intervals, for instance, every three hours, may have caused slight meningeal irritation, which was more severe when the punctures caused bleeding. Therefore, caution is advisable.

5. In spite of other positive observations in the fluid, microbes could be shown in only 13.2 per cent of the cases and then not at each puncture. A sterile fluid does not prove the absence of meningitis, because the cerebrospinal fluid, like blood, possesses bactericidal qualities. The observations may change from positive to negative and vice versa.

6. The other clinical observations (such as behavior of the animal, and desire to eat) in twenty of the twenty-three animals coincided with the conditions in the spinal fluid discovered by suboccipital puncture.

7. The histologic observations correspond with the quality of the fluid and confirmed the diagnosis made by examination of the fluid.

The cochlea was most severely affected, probably on account of the pathway of the infection through the window. The vestibular portion of the inner ear was less inflamed.

The aqueductus cochleae or the inner meatus, or both, may transmit the infection.

Virulent infections produced inflammatory changes in the meninges. Microbes could be shown in 40 per cent of the cases, contrary to the results of observations made on the fluid.

Naturally, observations on rabbits cannot be applied unconditionally to man, because anatomic conditions are different and because immunobiologic conditions exist. In the animal, pure cultures were brought directly into the labyrinth. In man, even if he is weakened by the infection, the defense mechanism must be taken into account when an inflammation of the middle ear extends to the cranium, following retention. Nevertheless, the observations coincide with those of the conditions in man. The value of observations on the cells and albumin in suboccipital puncture should be emphasized, as should the importance of bacteriologic observations. This applies also to general diseases, for instance, to tuberculous meningitis. In order to make an early diagnosis, a spinal or suboccipital puncture, including all details of examination, should be made in all doubtful cases.

PERICHONDRITIS OF THE AURICLE SHOWN BY ROENTGENOGRAMS. HELMUTH RICHTER, Ztschr. f. Hals- Nasen-u. Ohrenh. **17**:492 (March 18) 1927.

The roentgenogram showed plainly the changes of form and size of the concha and the cartilage in the acute inflammatory stage and after the inflammation had disappeared. The formation of abscesses and the extent of the destructive process in the region of the cartilage were well depicted.

EFFECT OF BORIC ACID IN ACUTE AND CHRONIC OTITIS MEDIA. ERICH WIRTH, Ztschr. f. Hals- Nasen-u. Ohrenh. **17**:499 (March 18) 1927.

The author studied the effect of boric acid on fifteen varieties of microbes: *Streptococcus hemolyticus, Streptococcus viridans, Streptococcus anhemolyticus,* the four types of pneumococcus, *Staphylococcus aureus* and *albus,* influenza bacilli, *Bacillus proteus, Bacillus fluorescens, Bacillus pyocyaneus,* capsulated and pseudodiphtheria bacilli. Boric acid impeded the growth of these microbes considerably, when 2 and 4 per cent solutions were added to Schottmueller's blood agar and blood bouillon. Some species showed little growth on 2 per cent boric acid blood bouillon. The nutrient mediums with 4 per cent boric acid remained unchanged after inoculation with the fifteen kinds of microbes. The germicidal effect of boric acid was noticeably less. The duration of disinfection of a suspension of microbes in bouillon with an addition of 3 per cent boric acid was: for influenza bacilli, from one to three hours; for the four types of pneumococci and anhemolytic streptococci, from three to five hours; for capsulated bacilli, from five to ten hours; for hemolytic streptococci and proteus bacilli, from ten to twenty-four hours; for pyocaneus bacilli, fluorescence bacilli and *Streptococcus viridans* (Schottmueller), from twenty-four to forty-eight hours; for *Staphylococcus aureus* and *albus,* from forty-eight to sixty-four hours. The effect of boric acid in infected tissue was not deep. The effect of boric acid in lessening virulence could be demonstrated only with the hemolytic streptococci; yet only an individual effect was exercised on the germs. The former virulence reasserted itself on favorable nutrient soil.

The disinfecting property is only one of the pharmacologic qualities of boric acid. The result in vitro cannot, without qualification, be compared with the effect in otitis media. In the latter it is more favorable, according to therapeutic experience.

AMBERG, Detroit.

TUBERCULOSIS OF THE MIDDLE EAR IN (PHTHISICAL) PATIENTS WITH TUBERCULOSIS. N. R. BLEGVAD, Acta oto-laryng. **10**:513, 1927.

Because the symptoms are not apparent at first, the otologist seldom sees this rare condition at its onset. The author has had the opportunity of observing tuberculosis of the middle ear from its onset. There is no pain, but the deafness is noticeable. There is often a little swelling and dulness of the membrane and in some cases ringing. At the beginning the picture resembles that of subacute otitis media. There is no retraction, but one sees the characteristic translucent red of otitis media. The lines of exudate are not seen, and there is usually no injection of the vessels at the periphery of the tympanum. On close examination one finds the radial vessels dilated and engorged, especially toward the periphery and in front.

If the disease progresses, the membrane swells, especially above and in front, so that the short process is obscured. The swelling may be sufficient to cause the handle of the malleus to lie in a fold caused by the bulging membrane on either side. At the same time the color turns to a yellow, and there is considerable dilation of the radial vessels as well as those along the handle of the malleus. On the contrary, the vessels at the periphery are rarely dilated.

The course is benign. In some cases, the tuberculosis is cured without leaving a trace. In general, it produces perforation due to necrosis. Following the perforation, there may be a mixed infection which makes the prognosis less favorable. Suppuration may cease, but cicatrization of the tympanum is rare, and the hearing remains unimproved.

The author reported thirty-five cases in patients seen over a period of ten years.

ROTH, Kankakee.

Larynx

LARGE PLAQUE OF LEUKOPLAKIA INVOLVING THE LARYNX AND TRACHEA. J. ROUGET, Arch. internat. de laryngol. otol. rhinol. **6**:427, 1927.

Leukoplakia of the right vocal cord and anterior wall of the trachea is described. The plaque on the cord was gray, raised, irregular and verrucous in appearance. Biopsy established the diagnosis of leukoplakia.

FOUR CASES OF LARYNGEAL TUBERCULOSIS IN CHILDREN CURED BY ARTIFICIAL PNEUMOTHORAX. HENRI CABOCHE, Ann. d. mal. de l'oreille, du larynx **46**: 445, 1927.

The author reports four cases of laryngeal tuberculosis in which a cure was effected mainly by artificial pneumothorax.

CASE 1.—A boy, aged 13, whose mother had died of tuberculosis, was seen on June 21, 1921. He had a cough, evening temperature, loss of appetite, emaciation, bacilli in the sputum, and a positive cutaneous reaction. Pneumothorax was practiced on Feb. 26, 1922; the larynx showed some thickening on the anterior surface of the right arytenoid. The lesions had completely disappeared in March, 1923.

CASE 2.—A boy, aged 14, was seen on March 25, 1922. He gave a history of hemoptysis, involvement of the left lung and bacilli in the sputum. Examination

of the larynx showed papillary thickening between the arytenoids and in the cavity of the larynx. Pneumothorax was accomplished on April 14, 1922; improvement was noticed on July 5. The patient was pronounced cured on June 28, 1924, more than two years after treatment was started.

CASE 3.—A boy, aged 14, whose mother died at the age of 29 of tuberculosis, was seen on March 4, 1922. The child showed a good general condition, but had fever. The left lung was involved, and bacilli were found. Examination of the larynx showed thickening of the anterior part of the left arytenoid with some encroachment on the cords. Pneumothorax was practiced on Feb. 3, 1923. The patient was pronounced cured on March 16, 1924.

CASE 4.—A boy, aged 13, was seen on March 15, 1922. He had fever and bacilli were found in the sputum. Artificial pneumothorax was induced on July 1, 1922. The larynx showed some infiltration of the arytenoids. He also had a lupus of the nose and large cervical adenitis. The patient was pronounced cured as far as the larynx was concerned, on March 26, 1923. On June 10, 1923, the patient had a sudden hemorrhage from the opposite lung, which resulted in his death.

The author believes that the percentage of curability in laryngeal tuberculosis can be greatly increased by the practice of pneumothorax, combined with the present climatic and dietetic measures.

ROTH, Kankakee.

TREATMENT FOR VARIOUS KINDS OF STENOSES OF THE LARYNX. GUSTAV SPIESS, Ztschr. f. Hals- Nasen-u. Ohrenh. **17**:439 (March 18) 1927.

Proper treatment of stenoses of the larynx depends on the etiology and the conditions present. Acute and chronic stenoses and stenoses caused by paralysis of the nerve, by inflammatory fixation of the joint, by tuberculosis and by syphilis must be treated differently.

The author proposes a new treatment for stenosis following influenza and that following ulcerative processes of the vocal cords. In a unilateral or bilateral perichondritis of the arytenoid cartilage caused by influenza an emergency tracheotomy frequently disposes of part of the stenosis; yet there is danger that the mechanical impediment of the movements will fix the immobilized arytenoid joint.

For acute and the subacute symptoms of inflammation, the patient must be treated energetically by local injections in order to prevent ankylosis. Once or twice a day, from 1 to 1.5 cc. of a sterile solution of procaine epinephrine must be injected alternately into the laryngeal and into the esophageal side. After a short time the first signs of motion of the previously fixed vocal cords can be observed.

The second form of adhesions following ulcerative processes of the vocal cords frequently demand tracheotomy. Dilatation (O'Dwyer, Schroetter-Bruenings, Thost, Brueggemann) cannot prevent new adhesions, especially at the anterior angle of the glottis. The author recommends a free surgical exposure of the glottis, to be followed daily or every other day by vigorous stretching with an instrument similar to a glove stretcher. In the beginning this should be done under cocaine anesthesia, with sustained and slow pressure. This method can be used easily from the tracheotomy opening, which should be enlarged by Thost's obdurators so that the stretching instrument can be introduced without resistance. The author uses obdurators which are longer than those of Thost in order to reach higher than the subglottic space. If they are too thick, they may cause decubitus. Reactive swelling can be influenced by daily instillations

of procaine. The stretching instrument can also be used to expose and fix the larynx for surgical intervention. (The instrument can also be used from above.) This form of treatment is not especially painful.

AMBERG, Detroit.

STUDY OF THE RAPIDITY OF PRECIPITATION OF ERYTHROCYTES IN TUBERCULOSIS OF THE LARYNX. OTTO BOSERUP, Acta oto-laryng. **10**:344, 1927.

Westergren has shown that the rapidity of the precipitation of the erythrocytes increases constantly in all cases of active pulmonary tuberculosis. He has also shown that the reaction possesses great value from the point of view of prognosis. The study of the precipitation of red cells has assumed great proportions in all institutions interested in pulmonary tuberculosis.

The writer was interested in the value of the reaction in relation to laryngeal tuberculosis. The problem is difficult because of the concomitant pulmonary tuberculosis. However, Westergren found that the biopsies in laryngeal tuberculosis gave results coinciding with those of the reaction of precipitation.

The technic of Westergren was employed. The citrated blood was placed in sedimentation tubes 300 mm. in height with a lumen of 2.5 mm. Readings were made after ten minutes and continued for one hour.

The observations were carried out on all patients with laryngeal tuberculosis in the institution. As some of the patients were not subject to prolonged observation, the final number of valuable cases was reduced to forty-five.

The conclusions reached were that the lesions of the larynx did not have an appreciable effect on the reaction of precipitation because of predominance of other factors, principally the pulmonary lesions. The reaction may prove of value in laryngeal tuberculosis, in studying the general condition of the patient to judge whether the resistance is such as to warrant surgical procedures or treatment.

EARLY DIAGNOSIS OF LARYNGEAL TUBERCULOSIS. N. R. BLEGVAD, Acta oto-laryng. **10**:508, 1927.

The author summarized the cardinal points in the early diagnosis of laryngeal tuberculosis under three headings.

1. Swelling and redness of vocal processes. Pachydermal swelling alone of the vocal processes is extremely suggestive of tuberculosis.

2. Prolapse of the ventricle of Morgagni. This condition does not always constitute an eversion, properly speaking, of the mucosa of the ventricle, but a swelling of the mucosa of the superior cords or the surface of the inferior cords. The simple or double prolapse in tuberculous persons is an almost certain sign of beginning laryngeal tuberculosis.

3. Swelling of the inferior aspect of the vocal cords is always fairly suggestive of the advent of tuberculosis in the larynx; however, it is a less reliable sign that the prolapse of the ventricle of Morgagni or pachydermal swelling of the vocal processes.

ROTH, Kankakee.

Nose

SINUS THROMBOSIS IN INFANTS. OSCAR HERZ, Monatschr. f. Kinderh. **32**:256, 1926.

The author brings out the fact that otologists and pathologists are ascribing an ever increasing importance to otitis media in infants, and points out the difficulty in making the diagnosis, owing to the masking of sinus thrombosis by conditions produced by it. The author states that 75 per cent of all children

who die in infancy show some form of otitic disturbance which escaped observation during life. Obscure temperature variations are too often ascribed to a transient pharyngitis, on the basis of a slight redness of the throat. The author feels that the pharyngitis is often not the cause for the temperature but that the ear is responsible.

Pediatricians have heretofore paid but little attention to "concomitant otitis," feeling that it was merely an expression of loss of immunity on the part of the patient. Finkelstein says: "To what extent the embryonic character of the mucous membrane of the middle ear continuing for some months after the fetal period, and finally hyperemia, hemorrhages, and disturbances to circulation in connection with birth, should be taken into consideration is a matter of small importance to the practitioner because of the unimportant character of these forms." Newer investigations do not support this view. Various pathologic studies, including those of Vosz, Tröltsch, Schwarze, Wreden, Hoffmann and Kutscharianz, show that the organ of hearing is easily damaged by the trauma of childbirth, this trauma being indicated by a dilatation and filling of the vessels throughout the petrous bone, evidences of purulent or mucopurulent catarrh of the middle ear, venous hyperemia of the cerebral meninges, and filling of the brain with fluid, and hyperemia of the labyrinth. From such observations it is apparent that there is a certain relation between the traumatic injury to the brain at childbirth and otitis in infancy. The author feels that inflammation of the middle ear in the new-born may be explained by increased susceptibility to infection caused by congestion and hemorrhage of traumatic origin. He is unable to evaluate the aspiration of vomitus or liquor amnii as a cause for infantile otitis.

A complication of otitis media, sinus thrombosis, formerly thought to be marantic in origin, is today ascribed practically always to infection.

Thrombosis in infants terminates in death in practically every case. The diagnosis is attended by considerable difficulty, owing to the fact that infants, as a rule, do not have chills, and that the thrombosis is obscured by other diseases which are the result and not the cause of the thrombosis. Among such other diseases the author mentions embolic metastasis in the lungs, causing empyema or bronchopneumonia, pyemia with abscesses and intestinal disturbances. Symptoms such as strabismus, nystagmus, protrusion of the fontanel, cramps and stiff neck, are not of assistance in cases of negative lumbar puncture. They are, however, of value when the puncture shows a greenish red or yellow fluid which does not coagulate and which yields a sediment of shrivelled erythrocytes. The author thinks that these observations following lumbar puncture are characteristic of sinus thrombosis.

On the basis of his experience the author feels that the following symptoms in the first weeks of life arouse a suspicion of sinus thrombosis, which ought to be verified by lumbar puncture: continuous vomiting, nystagmus, strabismus, protruding fontanel and cramps, particularly when associated with bronchopneumonia or empyema, and with typical observations following lumbar puncture.

The author is unable to suggest any therapy.

CASE REPORT: SINUS THROMBOSIS WITH GENERAL SEPSIS IN A YOUNG CHILD; RECOVERY. K. OCHSENIUS and V. SONNENKALF, Monatschr. f. Kinderh. **32**:530 (July) 1926.

The authors report a case of sinus thrombosis following acute otitis media and acute suppurative mastoiditis in a child, aged 4. The infection started as a simple acute otitis media without complications and seemed to respond well to paracentesis and ordinary treatment. However, the postoperative course was

complicated by high temperature, chill and leukocytosis, and reoperation disclosed a thrombus in the transverse sinus. The sinus was opened; subsequently the jugular vein was ligated and intramuscular injections of the patient's own blood were made. These measures controlled the infection.

The patient later developed an exudate in the right pleural cavity, examination of which demonstrated pneumococci. This complication cleared up under aspiration.

The authors report this case because such an otitic complication is rather unusual in a child of 4 years, because the mastoid process showed little disease, and because the lung infiltration developed at the time when the temperature of sepsis was diminishing. The main effective remedy, aside from the surgery, appeared to be an injection of the patient's own blood.

CONNOR, St. Paul.

CONCERNING ORBITAL INFLAMMATIONS IN EARLY CHILDHOOD. F. SAEGER, Klin. Monatsbl. f. Augenh. **78**:650-663 (May) 1927.

The author states that in adults inflammation of the nasal sinuses is certainly one of the most common causes of orbital inflammations; but many ophthalmologists believe that this is not true in childhood. He quotes Coakley's opinion that disease of the sinuses is encountered as frequently in children as in adults and mentions the work of Harke, Oppikofer, Wertheim and Wolff as showing by autopsies that the nasal sinuses of children are involved as are those of adults by the acute infections. The author also mentions the work of Onodi proving that the sinuses are involved in childhood. The author states that in the first year of life, nevertheless, establishment of disease in the individual sinuses meets with difficulties.

The author gives a review of the embryology and development of the nasal sinuses along with several plates taken from Onodi's Atlas on the nasal sinuses in children (1911).

Saeger collected from the literature and described sixty-seven cases of orbital complications following nasal sinus disease in children; the youngest patient, reported by Wildenberg, was a 3 day old infant, and the oldest was 16 years of age. To these sixty-seven cases he adds one proved case of his own, i. e., that of a 3 year old boy who had had whooping cough. There was an increasing swelling of the left eye showing a high grade inflammatory exophthalmos with the eyeball protruding forward and outward. The eyelids were swollen, reddish and edematous. There was slight chemosis, very slight conjunctival secretion and marked interference with the eye movements; in fact, the only eye movement was a slight outward one. The left fundus showed dilatation of the veins, but otherwise nothing abnormal. No mention is made of nasal examination. Operation by Professor Axenfeld of the University Eye Clinic in Freiburg showed pus beneath the orbital periosteum in the region of the middle and posterior ethmoid cells, with a sequestrum of the os planum and pus in the ethmoid cells. Convalescence was uneventful, though the eye remained in a divergent position. Bacteriologic studies in this case showed pneumococci in pure culture.

Saeger reports a second case in a girl, aged 19 weeks, who for two days had shown a swelling of the left eyelids so that they were raised in the form of a half circle. The skin of the eyelids was tense and the eyelids could not be opened passively. The eyelids were livid red and of solid consistency, which was more marked in the lower lid. When the upper lid was raised with a lid hook, no real secretion was present, but there was a marked chemosis, especially in the lower part. A high grade of exophthalmos was present. The cornea

was clear, and the pupil, though dilated, still reacted. The media were clear. Ophthalmoscopic examination showed venous congestion but no papillitis. Ocular movements were diminished in all directions. Rhinologic examination did not show anything abnormal in the ears, nose or throat. The child had high fever. The opinion was that a suppurative orbital inflammation, perhaps under the periosteum, existed in this case. Under ethyl chloride skin anesthesia, a deep incision was made in the region of the lower eyelid, with the evacuation of large drops of pus. The patient recovered, and though there was no definite evidence pointing to any disease of the sinuses, the author felt that a maxillary sinus disease was probably present.

The third case reported by Saeger is that of a girl, aged 2¼ years, whose physical condition was poor, after an attack of lower lobe pneumonia resulting from measles. She had a discharge from both middle ears, tender mastoid processes and a bilateral rhinitis, with bloody, purulent discharge. On the fifth day of observation, swelling and redness of the left upper eyelid appeared, followed in two days by infiltration of the upper and lower eyelids, and chemosis. Soon after, the same process appeared in the right eye. On the ninth day, the child was dizzy and had high fever, and death followed circulatory weakness. At autopsy were found a thrombosis of the transverse and cavernous sinuses on the left side, probably from the left otitis media, and local suppurative meningitis of the left cranial fossa and left temporal lobe. Culture showed *Staphylococcus pyogenes aureus*. Microscopic studies of the orbit and eyelids showed suppurative thrombophlebitis of both orbits. The author feels that though, strictly speaking, the thrombophlebitis of the orbits was due to the phlebitis in the transverse sinus and cavernous sinus extending forward, still this case may be considered rhinogenous, because the bloody suppurative discharge from the nasal sinuses infected the mastoids.

According to Saeger, some authors feel that there is a predisposing factor for orbital complications in children, but in the Freiburg Eye Clinic the feeling is that an essential predisposition for rhinologic orbital inflammation does not exist in childhood.

In his summary, the author states that it is well known that the most common cause for orbital phlegmon in adults is inflammation of the nasal sinuses. It has been asserted that this rhinologic etiology in early childhood does not hold the same relation, because the sinuses grow slowly and their extent and depth are slight. Opposed to this, is the opinion of the rhinologists who believe that acute inflammation of the sinuses in early childhood is frequent but seldom diagnosed, that the acute process is not less common in children than in adults and also that severe rhinogenous orbital complications are possible in small children.

The author gives an extensive bibliography. VAIL, Cincinnati.

Miscellaneous

A PLEA FOR CONSERVATISM IN THE TREATMENT OF OPTIC NERVE DISTURBANCE FROM FOCAL INFECTION. LEON E. WHITE, Laryngoscope **37**:327 (May) 1927.

White reports data derived from his last sixty cases, which have not been published. He says that it is usually possible to find the focus of infection, and, by eliminating it before the nerve is damaged, to obtain prompt recovery. It has been necessary to open the posterior sinuses in only a few cases. The routine opening of uninfected sinuses has been found unnecessary, and is to be condemned. White admits that in his first seventeen cases all infections were

attributed to sinuses. He says that the present literature shows that opening of accessory sinuses is done about the time the patient would normally commence to improve. The teeth and tonsils are rarely mentioned. White believes that extensive studies on anatomic relations of the optic nerves to sinuses have thrown the sinuses too much into the limelight, while the more remote sources of infection have been left in the background.

He says that pathologic examination of the tissues removed from the sinuses failed to convince pathologists that it was sufficient to account for the conditions of the eye. More remote sources of infection were then sought, and soon the tonsils appeared as important etiologic factors; then the teeth became possible factors. The antrum then took on an added significance, not as a sinus from which there might be direct extension to the optic nerve, but as a focus from which infection might pass by way of the blood stream or lymphatics to the nerve. At first it was the antrum that contained pus that was especially sought, but later marked thickening of the mucosa seemed fully as important.

The author has looked over more than 100 cases. He says: (1) that it seems that the infection comes either from some systemic condition, as influenza or intestinal toxemia, or from some definite focus such as the teeth, tonsils or sinuses; (2) that the infection travels by way of the blood stream and produces a neuritis of the optic nerve the same as any other nerve. The danger lies in the fact that the optic nerve degenerates easily and never regenerates. There is always a possibility that in a severe neuritis, optic atrophy may intervene before the inflammation subsides. It is a well recognized fact that in the majority of the cases of acute optic neuritis the patients recover spontaneously, so that if there were some method of distinguishing between those that might reasonably be expected to recover from those that might not, these patients could at once be dismissed.

As to the methods of differentiating the cases, the author says that the duration and extent of the loss of vision, the condition of the fundus, the virulence of the infection and the size of the optic canals must all be considered.

The conclusions reached were that unless there was improvement under treatment within a week, there was danger of permanent impairment of vision, while in cases of more than two months' duration, little could be expected except possibly checking the loss of vision by removal of some definite focus.

The author also found that the demand for early operative intervention in total loss of vision was more imperative than when the loss was partial.

When the nerve appears normal, one might with safety delay operating much longer than when there is increasing engorgement or commencing pallor.

Micro-organisms differ greatly in virulence. The optic nerve is really not a nerve but a part of the brain. The nerve fibers are devoid of a sheath of Schwann, and the interstitial substance is neuroglia.

Not all patients recover spontaneously. Blindness follows in a certain percentage of cases. The problem is to separate the cases in which spontaneous recovery might be expected from those in which permanent damage would follow if the patient was not treated. Cushing reported several cases of meningitis following irrational surgical intervention on the ethmoid (i. e., when the diagnosis was faulty).

White asks: Is it possible after a careful study of these cases to differentiate between them? He answers: To a considerable extent, yes; to an absolute certainty, no. There are cases of so slight a transitory nature that it would be nearly criminal to submit these patients to any surgical procedure not indicated by rhinologic examination. Infected teeth and tonsils should

be removed. If the antrum is diseased, it should also be attended to. The author believes that exenteration of ethmoids and sphenoids not so evidently diseased that they require opening irrespective of the condition of the eye, is a gross but too common error. Patients with mild cases recover without treatment or with ordinary local treatment. These cases are taken too seriously. Extreme measures are instituted when little or no treatment would suffice; while recovery may take place in spite of, rather than because of, these procedures, the patient is submitted to needless risks. Then again, there are patients with marked loss of vision and a normal optic canal. The focus should be sought and removed. If the posterior sinuses are markedly obstructed, aeration of this region is necessary.

The author says that 85 per cent of all cases arising from focal infection belong in these two groups, and that recovery in all should be obtained by conservative methods. In the remaining 15 per cent, in which there is a severe neuritis accompanied by marked or complete loss of vision, especially when the patient has an optic canal considerably below normal, White believes that in addition to the removal of the focus, it is usually advisable also to remove the middle turbinate, take down the front wall of the sphenoid and uncap the posterior ethmoid cell. This procedure is especially advocated if the blindness is of several days' duration and the fundus shows changes of engorgement or commencing atrophy. In none of the cases does White advocate exenteration of any of the other sinuses unless the pathologic condition is severe enough to warrant it. Since he has followed these procedures his results have been as good as when, as a matter of routine, he opened the posterior sinuses.

In June, 1926, White presented a paper on "The Influence of Negative Pressure in the Sphenoid on the Optic Nerve" at the American Laryngological Association in Montreal, in which he stated that he believed that the benefits following opening of the posterior sinuses resulted from the relief of the negative pressure and not from the removal of a focus of infection.

Sinuses play a minor rôle in iritis and in optic neuritis. White says that it is imperative for one who studies lesions of the optic nerve to be conversant with all possible sources of infection. The sinuses, owing to their propinquity, have long shouldered the responsibility, but this burden must now be distributed among the teeth, tonsils, sinuses, prostate, appendix, gallbladder, fallopion tubes and intestinal tract.

The author gives an outline of his method in investigating cases. A correct diagnosis is naturally essential before operation is advised. A careful nasal examination should be made. One important point to determine is the size and position of the middle turbinates. He believes that whenever there is no blocking of the normal openings of the posterior sinuses, this region can be ruled out as a causative factor in the neuritis. One must not expect to find the common symptoms of open sinusitis. The tonsils and teeth should be examined, roentgenograms should be taken and a complete general and neurologic examination made. Diagnosis is made by exclusion many times. Unless some definite focus is found, it is usually best to treat the patient locally by using a nasal spray of 10 per cent mild silver protein and epinephrine every three hours, hot saline irrigation, mild silver protein tampons, etc.

Of the sixty cases, which White has not reported, the tonsils were the only focus of infection in seventeen, the teeth in fourteen and the antrum in two, the teeth and tonsils in four and the teeth, tonsils and antrum in six. The ethmoids were the focus of infection in six cases, and in these, the teeth, tonsils or antrum were also infected.

The posterior sinuses were opened in only nine of these cases. In two, the patient recovered, which probably would have happened anyway, and in five, the patients were not benefited.

A definite focus was found in fifty-three cases, while in three the condition was thought to be systemic (diabetes, hyperthyroidism, and postscarlatinal). Results of examination in two cases were negative, and one patient had an acoustic neuroma. The author reports that the surgical elimination of the focus was followed by normal vision in twenty-three cases, marked improvement in twelve, slight improvement in five and no improvement in six. Operation was refused in seven cases; in six of these there was improvement; in one, normal vision returned. The teeth and tonsils appeared to be the foci in about 70 per cent of the cases, while the ethmoids were involved in only 10 per cent. Thus, the nose is not so important in this condition as was once thought.

In the summary the author says that it is usually possible to find the focus of infection. Nasal obstruction, when well marked, should be removed. As the posterior sinuses are rarely infected, it is unnecessary to open them except in a few desperate cases. Removal of infected teeth and tonsils proved to be a most effective method of treatment. The prognosis is dependent on the duration and extent of the loss of vision, the condition of the fundus, the virulence of the infection and the size of the optic canals.

About 85 per cent of the patients will recover under conservative treatment, such as local medication and the removal of some definite focus (i. e., teeth or tonsils). In the remaining 15 per cent of the patients it is usually advisable to remove the focus and the middle turbinate and to open the posterior sinuses.

A definite focus was found in fifty-three of the sixty unreported cases. The tonsils appeared to be the only focus in seventeen, the teeth in fourteen and the antrum in two. The teeth and tonsils, either alone or combined, were considered to be the focus in 70 per cent. The ethmoids were involved in but six cases and even in these, the teeth, tonsils or antrum were infected. The frontal and sphenoid sinuses were each involved but twice. The removal of the focus was followed by normal vision in 50 per cent of the cases and marked improvement in 25 per cent.

VAIL, Cincinnati.

INJECTIONS OF LIPIODOL TRANSGLOTTICALLY IN CHILDREN. C. J. A. VAN ITERSON and D. J. STERNTUIS, Arch. internat. de laryngol. rhinol. **6**:399, 1927.

The various methods of injecting lipiodol into the trachea and lungs were reviewed. The authors use the same method and instruments in children as in adults. The pharynx is rendered insensible with a 1 per cent solution of cocaine. The larynx is then anesthetized with a 10 per cent solution of cocaine. The oil, slightly tepid, is introduced by the indirect method by means of a syringe with a curved cannula. The cannula has several openings, but the end is closed. From 20 to 30 cc. is usually sufficient in children.

TUBERCULOSIS OF THE RESPIRATORY APPARATUS. L. DE REYNIER, Arch. internat. de laryngol. otol. rhinol. **6**:404 (April) 1927.

In considering conditions of the respiratory apparatus, the lungs should not be regarded separately from the upper respiratory passages. Not only may lesions in one field influence lesions in the other, but the treatment for one condition may effect a cure in the other.

Many of the symptoms of the so-called latent or abortive tuberculosis, such as cough, expectoration or lowering of the general health may not be of tuber-

culosis origin, but may be due to nasal stenosis, low grade sinusitis or rhinopharyngeal inflammation. Many tuberculophobias may be traced to the fact that the internist disregarded the upper respiratory passages. The author believes that a rhinopharyngeal examination should be fundamental in the consideration of tuberculosis, especially in children and adolescents. On the other hand, laryngologists should not forget that in certain cases the first symptoms of pulmonary tuberculosis consist only of aphonia, sometimes total and lasting for one or more months, little, if any, cough, temperature normal, slight lassitude and negative stethoscopic or roentgenographic observations. The author believes the aphonia may be due to a paralysis of the laryngeal nerves by tuberculous intoxication. However, an excess is as dangerous in one direction as in the other, and a rhinophobia is as dangerous as a tuberculophobia. The efforts of the rhinolaryngologist and the internist should be combined in ferreting out the causes of morbid symptoms of the entire respiratory tract.

The author reviewed the prevailing general and local treatment of tuberculosis and the indications for surgical intervention and phrenectomy. Patients for whom surgical treatment is not suitable should be treated with tuberculin under suitable conditions. This method of treatment was abandoned after a period of enthusiasm, but today it is being used with success. It should be used cautiously, however.

The author found not only in the dispensaries but in the literature that pathologic conditions of the nose were more frequent in the tuberculous and advances the opinion that they may play an important rôle in pathologic changes in tuberculosis.

Tuberculous Meningitis and Auricular or Sinus Suppuration. Georges Portmann and J. Despans, Rev. de laryngol. June 15, 1927, p. 31.

Two cases were presented in which the authors reported that an error in diagnosis was made. In the first case tuberculous meningitis was mistaken for a frontal sinus infection with meningeal complications. The other case was of meningeal involvement of otitic origin which was thought for many days to be tuberculous meningitis. The diagnosis between tuberculous meningitis and common suppurations of the ears and sinuses may sometimes be difficult, because the two conditions might coexist.

Roth, Kankakee.

The Pathology of the Esophagus in Childhood. Carl Stamm, Monatschr. f. Kinderh. **33**:147 (Aug.) 1926.

The author points out that a diverticulum of the esophagus in an infant 6 months old is a great rarity which has been neither clinically diagnosed nor observed at autopsy. The etiologic division of diverticula into pulsion and traction diverticula, made in 1877 by Zenker and von Ziemsen, is still correct. The author reports a case of an infant aged 6 months, of normal delivery, brought to the hospital on account of inability to take nourishment, feeding being attended by marked dyspnea and attacks of suffocation. Nothing could be done for the child, and at autopsy a diverticulum of the esophagus was found, evidently of the traction type, because the lower lobe of the left lung was adherent to the sac by means of firmly attached strands of connective tissue, apparently the remains of an old pleuritis.

The author also reports a case of cauterization of the esophagus in a boy, aged 4 years, following the ingestion of lye. On admission to the clinic, liquids only could be taken, but by the use of graduated bougies the child was ultimately enabled to take all types of food.

The author reports another case of the same type in a boy 2¾ years old. The use of the bougie enabled the child to take foods of semisolid consistency and effected improvement, but the patient was never free from difficulty. At times he ate with apparent ease, and at other times he absolutely refused all food and vomited on forced feeding. On subsequent admissions to the clinic the author made a diagnosis of diverticulum of the esophagus and attempted an operative correction which proved fatal. A postmortem examination showed a cicatricial stenosis of the esophagus, with a marked ectasia of the esophagus above the stenosis, and hypertrophy of the walls.

CONNOR, St. Paul.

CLINICAL INVESTIGATIONS WITH MUCK'S EPINEPHRINE PROBE TEST. WALTER HESSE, Ztschr. f. Hals- Nasen-u. Ohrenh. **17**:520 (March 18) 1927.

The author states that the reaction, as a rule, was normal in vasomotor rhinitis, hay-fever, coryza, bronchial asthma and struma, with or without symptoms of exophthalmic goiter. Sometimes the reaction could be explained as a result of a preponderance of the parasympathetic, more rarely of the sympathetic system. Typical migraine, however, differs from headaches from other causes in that a sympathicotonic reaction usually occurs. Hereby the idea that a spasm of the constrictors is an exciting factor in migraine receives new support. Remedies which tend to paralyze the sympathicus are suggested.

THE PHYSICAL PRINCIPLES OF STROBOSCOPY. A NEW LARYNGO-STROBOSCOPE. HEINZ DAHMANN, Ztschr. f. Hals- Nasen-u. Ohrenh. **17**:560 (March 18) 1927.

The laryngostroboscope is necessary for the investigation of the normal and pathologic behavior of the vocal cords during speaking and singing. Recently, Hegener and Panconcelli-Calzia studied the technical and experimental phases of stroboscopy. Hegener added the stereoscopic observation by employing prisms and lenses. Binocular vision shows the thickness of the vocal cords, their position in relation to each other, etc. Furthermore, Calzia-Schneider and Hegener succeeded in making stroboscopic-kinematographic exposures of movements of the larynx. A clear stroboscopic image depends on a completely quiet, constant and bright light. The disk must move absolutely smoothly and the perforations must be of the same size and placed an equal distance from each other. Vibratory or jerking motions of the disk must be avoided. In addition, one must consider that the movements of the vocal cords can best be observed if the single images are small. Therefore, the opening must be small. The relationship between the diameter of the opening and the intervening mass should be from 1:10 to 1:20. This relationship must be changed under certain circumstances. The light must be fully utilized and collected in a small and sharply defined focus by a system of lenses. Dahmann succeeded in obtaining a sharply circumscribed focus which was 1.5 mm. in diameter. A second irradiation at a distance of about 1 cm. from the focus, emanating from the negative electrode, must be counteracted.

The tone pitch and the number of the periodic interruptions of light per second demand great attention, because each tone is not within the tone register of each person. The simplest method is to use a rheostat. A disk with a larger or smaller number of perforations may also be used. The author cites the disadvantages of changeable friction transmission. Finally, changes of the main electric current of short duration must be considered. These changes are not rare, and they manifest themselves by variations in the intensity of light which may last for seconds. Dahmann describes and depicts his apparatus.

AMBERG, Detroit.

Society Transactions

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY

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BURT R. SHURLY, M.D., *in the Chair*

DOES A DIET DEFICIENT IN VITAMIN AFFECT THE BONE LABYRINTH? A REPORT ON THE RESULTS OF ANIMAL EXPERIMENTATION. Presented by DR. ROY A. BARLOW, Madison, Wis.

As rickets is often associated with deafness and is known to be due to dietary deficiencies, the question arises as to whether bony changes in the labyrinth, similar to those in other bones, may not be the etiologic factor. If it can be demonstrated that there is a lack of calcium in the bony capsule of the labyrinth in patients fed on a diet deficient in vitamin D, which controls the deposition of calcium, then such an assumed etiologic relationship between diet and deafness is tenable, and may be a new point of attack on the unsolved problem of otosclerosis. The present study was carried out by feeding rats with a diet deficient in vitamin D. A marked loss of calcium was thus produced in the long bones, which was clearly demonstrated by roentgenograms. The rats were then killed and the bony labyrinth removed. Frozen sections were made of from 30 to 40 microns in thickness and were immersed in a 5 per cent solution of silver nitrate, with a resulting precipitation of the silver by the calcium in the bone. The depth of the color of this deposit gave a fairly accurate index of the amount of calcium, since the more calcium present, the more silver precipitated by contrast with normal labyrinths, when other bones, such as the wrist, were treated in a similar way, it was possible to estimate the deficiency of calcium in the labyrinth in rats fed on a diet lacking vitamin D. The results afforded clear evidence that a loss of calcium could not be demonstrated in the labyrinth of such animals which exhibit, at the same time, extreme loss of calcium in their other bones. Hence there probably is no relationship between this type of dietary deficiency and deafness.

Roentgen-ray studies of normal and rachitic labyrinths did not show any differences in shadow density.

DISCUSSION

DR. NORVAL H. PIERCE, Chicago: This is a step in the right direction, and we need more men for such research. I have not found any dietary modifications which produce labyrinthine changes similar to those in otosclerosis, in which the bony abnormalities occur in sharply demarcated areas, suggesting that this disease is concerned with the terminal blood vessels in the bone. The bony labyrinth has three osteogenetic sources, but only one of them, the interchondral, is affected in rickets, in which the cartilage cells do not ossify as they should. More advanced and satisfactory methods for the pathologic examination of bone are needed, since present methods of section after decalcification change the finer structural detail.

DR. EDWIN S. INGERSOLL, Rochester, N. Y.: The relationship between dietary deficiencies and suppuration of the middle ear or mastoid needs investigation. In a recent group of forty-five patients with this condition twenty, who did not show any signs of deficiency in vitamin A or D, recoved without operation. Of the remaining twenty-five, all operated on, eight were breast fed and seventeen showed a lack of vitamin D.

Dr. Lee W. Dean, Iowa City: We have one ward, in charge of Dr. Daniels, in which all the infants are fed on a proper diet from birth, and in which we have never been called to see a patient with an acute infection of the middle ear, adenoids, maxillary sinusitis or cervical adenitis. Such diseases are always to be found in the general ward in infants brought in from the home.

Dr. Max A. Goldstein, St. Louis: I have seen two congenitally deaf children with some residual hearing, improve considerably after being fed on a diet rich in vitamin D.

Clinical Observations of the Diseases of the Nasal Accessory Sinuses. Presented by Dr. Joseph A. Stucky, Lexington, Ky.

Sinus infections can be divided into four progressive stages: (1) An acute stage manifested by fever and due to lack of ventilation of the sinus; (2) a subacute stage manifested by mucopurulent discharge, intermittent fever and some pain and due to blockage of the outlet of the sinus; as the exudate is bactericidal, it should be let alone; roentgenograms may show some clouding; (3) empyemic stage, characterized by an increase in the content of pus of the sinus; (4) stage of chronic suppuration with formation of a pyogenic membrane.

The treatment for patients with the first and second stages of sinus infection consists of a restricted diet, together with soda and orange juice, the local instillation of from 1 to 2 drachms of hypotonic salt solution and a semi-recumbent position for twenty-four hours. In the third stage, the nose should be irrigated anteriorly and postnasally with hypotonic saline solution, but there is no need to irrigate the sinus itself. A cure can be made in the fourth stage only by a radical operation such as the Caldwel-Luc.

Such sinus diseases have often been shown to be the result of dietary deficiencies, both experimentally and clinically, so that a properly balanced diet containing the required vitamins must be taken into consideration with the treatment. The local nasal manifestations are often simply indications of a systemic disturbance, for which the patient must be treated along broad and rational lines.

DISCUSSION

Dr. John J. Shea, Memphis, Tenn.: Many sinus infections occur in children whose tonsils and adenoids have been removed. I believe that in such instances the sinus is called on to produce bactericidal substances no longer furnished by the tonsils, and in doing so becomes so fatigued that infection occurs. In all sinus infections of this kind it is important to eliminate sugar from the diet, since on a given carbohydrate diet children with sinus infection will show a much higher amount of blood sugar than normal children.

Ventilation of the nasal passages is best accomplished by the instillation of a mixture of ephedrine in a saline solution (from 2 drachms to 4 ounces) every hour. Surgical treatment of the sinus should secure good and permanent ventilation, after which irrigation is not essential. Useful adjuvants are violet ray and noonday sun baths.

Dr. Georges Portmann, Bordeaux, France: I have had good results in cases of acute sinusitis by the use of repeated lavage with a surgical solution of chlorinated soda (Dakin's solution). I rarely find the external operation necessary in cases of chronic infection of the frontal sinus, and prefer the intranasal approach with curettage of the anterior ethmoid cells.

Dr. William Mithoefer, Cincinnati: I do not believe that dietary errors are the fundamental cause of sinus infection. The condition starts in the nasopharynx, and this region must be carefully examined and watched after any acute rhinitis, since insidious sinus infection, especially in the sphenoid, may be the next manifestation of residual nasal inflammation.

THE RELATION OF PROGRESSIVE DEAFNESS TO ENVIRONMENT. Presented by DR. D. C. JARVIS, Barre, Vt.

Investigation among workers in granite and silicon dusts has been conducted on a large scale, with normal college students as controls. Approached from a statistical, clinical and research angle, the problem has been to determine the etiology of progressive deafness among these men and the relationship between this disease and their occupation. If it is assumed that the development of the deafness is an indication of an inability of the body to adapt itself to a new environment, some local pathologic condition must be discovered favorable to the growth of the bacteria which presumably act as the infective agents to cause changes in the middle ear. This local pathologic condition in the present instance was found to be an increase of lymphoid tissue, both in the chest and the nasopharynx, which served as a soil for the bacterial growth. This lymphoid growth in the chest could be followed by roentgenograms and was found to diminish with cessation of work in silicon dust and to recur with its resumption. Another factor was the general absence of fats in the diet of these workers, which contributed to increased lymphoid growth. Hearing improved when fats were added to the diet. Another factor was the reduced alkalinity of the body due to the presence of silicic (O acid). Neutralization of this by alkalis such as sodium bicarbonate resulted in fewer nasopharyngeal infections, and hence less loss in hearing. An added advantage in treating these paients by these means is the prevention of a line of pulmonary complications to which they are prone, such as chronic bronchitis, bronchiectasis and tuberculosis. Many difficulties were encountered in this study, particularly in the accurate testing of the hearing after the institution of treatment and in the control of a more or less migratory group of men.

INJECTION OF THE GASSERIAN GANGLION IN TIC DOULOUREUX. Presented by DR. JOHN F. BARNHILL, Indianapolis.

Among the various types of severe intracranial pain, none is so distressing to the patient as true or major tic douloureux. With its pathologic process in the gasserian ganglion, the condition occurs intermittently and with sudden onset, at first at long intervals which become progressively shorter, always tending to become more and more severe. External pressure affords some relief to the attacks, which may be initiated by so slight a stimulus as a light breeze or a drink of water. Persons afflicted with this condition are usually over 25 years of age. The major form of tic must be distinguished from a minor form which has an extracranial pathologic process, usually in the nasopalatine ganglion, and which arises from some stimulation in the teeth or sinuses. Here the pain is constant, affecting patients of all ages, often children, and is relieved by the removal of the local cause.

Only two practical forms of treatment in cases of the major type of neuralgia are worth consideration: (1) the section of the posterior root of the gasserian ganglion, a difficult and serious intracranial operation, which will, however, afford a permanent cure and (2) alcoholic injection to the nerve at the point of emergence from the skull, relatively a much easier operation when the technic is mastered, and one affording relief for from four to six years and rarely for eight years. The injection must be actually in and not merely near the ganglion if good results are to be secured. The technic is as follows: The mouth is sterilized as well as possible, after preliminary narcotization with morphine and scopolamine up to the point of semiconsciousness. Local anesthesia is not used. An appropriate needle is then introduced through the pharynx and directed toward the foramen ovale, guided by two operators who adjudge the angles in two different planes; 0.75 cm. beyond the foramen is the center of the gaglion into which 95 per cent alcohol is slowly injected, from 3 to 4 minims at a time. Injection should never be made if blood or spinal fluid is seen coming from the needle. The attainment of the ganglion

can be determined by the sudden cry of pain when it is entered. Two more injections should be made as the needle is withdrawn 0.25 cm. at a time.

DISCUSSION

DR. H. L. POLLACK, Chicago: It is hard to differentiate between major and minor neuralgia at times; hysteria may be a confusing factor. Resection of the root, especially at an advanced age, is not always safe, and injection is to be preferred. One must guard against infection when making the injection via the mouth; the external approach is safer.

DR. BARNHILL: For successful results, the technic of this operation must be thoroughly worked out on specimens and on the cadaver before a patient is subjected to the procedure.

A CLINICAL AND LABORATORY NOTE ON THE COAGULATION TEST. Presented by DR. RICHMOND MCKINNEY, Memphis, Tenn.

Previous series of coagulation tests have tended to discredit the reliability of the procedure, since there does not appear to be any relationship between the length of coagulation time and the tendency to hemorrhage following tonsillectomy. In a more recent group of 982 cases, tested by two methods checking each other accurately, the shortest coagulation time was found to be one minute, the longest nine. The age of the patient was not a factor. A coagulation time of not over six minutes was considered within normal limits, and there was no bleeding in cases in which there was a time over this figure. The worst bleeding occurred in a patient with a coagulation time of five and one-half minutes. In this instance there was a history of previous bleeding, and calcium lactate had been administered for two weeks previous to operation, which was preceded by a dose of morphine and performed under local anesthesia. There was slight immediate bleeding requiring one suture, with subsequent and almost constant formation of repeated clots from each fossa. This was finally controlled but continued at intervals for two weeks before final cessation.

In another patient, a previous tonsillectomy at the age of 6 had been discontinued because of bleeding. The coagulation time at present was six minutes, the bleeding time seventeen minutes. After administration of calcium the coagulation and bleeding time became five and eighteen minutes, respectively. The tonsils were removed under local anesthesia without the least suggestion of hemorrhage, thus showing the discrepancy between the bleeding and the coagulation time. In another patient, aged 17, who had previously bled following the extraction of a tooth, and who had a coagulation time of seven minutes in spite of calcium, the tonsils were removed under ether anesthesia without bleeding.

The unreliability of such tests is brought out finally by the case of a boy, aged 16, subject to hematomas and with a definite family history of bleeding, whose red cell count was 3,000,000 and hemoglobin 70 per cent, but whose coagulation time was only eight minutes and bleeding time four minutes.

Hence the value of such precautionary tests would seem to lie, not in their clinical usefulness to indicate a possibility to hemorrhea, but in the fact that their omission is coming to be regarded by the public as an act of negligence on the part of the surgeon. The problem of preoperative detection of a real bleeder is still unsolved.

DISCUSSION

DR. WILLIAM V. MULLEN, Cleveland: One must distinguish between free bleeders and those who are truly hemophiliac. In the former, open vessels are usually the cause and the operative technic faulty; in the latter, the tendency of the patient to bleed is the cause, and it can best be discovered by carefully taking the history. Inaccurate as the coagulation test appears to be, it should be continued as a routine for the sake of the few possible cases that may be discovered by its use.

Dr. George M. Coates, Philadelphia: True hemophilia is a rare condition. I recall one woman with a family history of real bleeding, in whom one tonsil was removed and the operation discontinued because the bleeding was so profuse as to require transfusion. In spite of a long coagulation time, a subsequent removal of the other tonsil under local anesthesia was not followed by the least bleeding. In another instance of a boy, aged 4, whose blood failed to coagulate on testing, there was no bleeding at the time of operation. Inconsistent as these results are, the test must be done for the protection of the physician and that of the patient.

Dr. A. A. Hayden, Chicago: Two preliminary coagulation tests are made on all of our patients, and the public expect it as a routine. If only one dangerous case is detected, the procedure is worth while. A short coagulation time should not, however, lead to less careful operation. I recall a patient with a coagulation time of from five to six minutes in whom a tonsillectomy requiring sutures was followed the next day by a submucous resection. Six hours later, there was bleeding from the nose, and it continued for twelve hours. The patient received a transfusion from his sister without any cessation in bleeding after two hours. A second transfusion from his sister-in-law checked all bleeding in five minutes.

Dr. A. P. Voislawsky, New York: We advocate transfusion before operation in patients in whom hemophilia is suspected. There is a great danger of serious legal suits in cases in which the patients bleed, unless it can be shown that every known precaution was taken beforehand.

Dr. William Mithoefer, Cincinnati: I wish to mention two cases in which there was active bleeding from the skin, kidney and mucous membranes, which was controlled in five minutes by roentgen-ray treatment of the spleen.

Gross and Microscopic Pathology in Twenty Consecutive External Frontal-Ethmo-Sphenoidal Operations. Presented by Dr. W. Likely Simpson, Memphis, Tenn.

In a series of twenty-three patients with frontal sinus disease, treated by the radical external operation popularized by Lynch, the pathologic conditions were divided among the following: cysts, polypoid degeneration, bony necrosis, periostitis, granulomas and osteoma. These were associated in varying proportions with thrombosed vessels, ulcerations, subperiosteal hemorrhages and hyaline degeneration. The determination of the character and extent of the pathologic changes within the frontal sinus at the time of operation was greatly facilitated by the use of a small pharyngeal mirror whereby the various angles and depressions could be more easily seen. In general, there was a hyperplasia of the submucosa with its characteristic cellular changes, while the outstanding bony change was a widening of the haversian canals.

DISCUSSION

Dr. Thomas Carmody, Denver: Chronic infection may still leave the mucous membrane of the sinus intact and it may not be necessary to remove all of it, unless obliteration of the sinus is the objective. Osteomyelitis may occur in small areas and hence be easily overlooked.

Clinical Significance of Involvement of the Glands on the Floor of the Mouth. Presented by Dr. William Mithoefer, Cincinnati.

Low grade inflammation of the glands of the floor of the mouth such as the submaxillary, sublingual and others, may cause a variety of vague symptoms. The etiologic factor may be a tonsillar infection or diseased tooth which is draining into one or another of these gland groups. The condition, the symptoms of which are a sense of fulness and burning in the pharynx, may best be detected by a bimanual palpation of the floor of the mouth, with one

hand inside the mouth, the other outside. In this way sensitive spots may be discovered, especially the relation to the superior or inferior laryngeal nerves, so-called lingual neuralgia. Palpation of these sensitive spots, by making the symptoms worse will thus show the glands to be the real seat of the trouble.

The treatment of patients with such glandular infections should consist in gentle massage of the affected glands, and the administration of cinchophen and methenamine intravenously. Massage should last for only from three to five minutes, particular attention being paid to the regions of the sublingual gland, hypothyroid membrane and inferior laryngeal nerve.

Much of the usual pain following tonsillectomy is due to an acute involvement of the glands of the floor of the mouth; hence gentle massage and applications of heat to this region will make patients more comfortable. Similar glandular pain may follow a sinus infection.

DISCUSSION

DR. WILLIAM V. MULLIN, Cleveland: I question whether massage in these acute conditions might not have a tendency to spread an otherwise localized infection.

DR. THOMAS CARMODY, Denver: I have long urged the value of a careful examination of the glands of the floor of the mouth. The many ducts of such glands as the sublingual afford an easy access to infection. Disturbances of taste may be one of the symptoms of glandular infection in this region. Syrup of hydriodic acid and of ferric iodide are useful in the treatment of patients with these conditions, but should be preceded by the removal of all infected teeth. Even after the removal of the teeth the glandular disturbance will not always recede.

DR. MITHOEFER: One other useful therapeutic measure is the use of cinchophen administered intravenously. I have seen some striking results follow this method of treatment.

CLINICAL CONSIDERATION OF INFLAMMATIONS AND INFECTIONS OF EXTRA TONSILLAR PHARYNGEAL LYMPHOID TISSUE BEFORE AND AFTER TONSILLECTOMY

Presented by DR. VIVIAN V. WOOD, St. Louis.

The lymphoid tissue so often seen in the pharynx and on the posterior pillars following complete tonsillectomy may act as a focus of infection. That such a sequela will take place in a given case may often be suspected preoperatively by a study of the general lymphoid characteristics of the patient. On this basis, patients may be classified as follows: (1) those with a general diathesis toward general lymphoid hypertrophy; (2) those in whom lymphoid hypertrophy is confined to the tonsils or other areas; (3) those without any lymphoid hypertrophy, but in whom the tonsils are infected and (4) those whose lymphoid tissue is normal in appearance until some cold or infection results in hypertrophy, or in whom this takes place following tonsillectomy.

The postoperative prognosis varies in these four types of patient. In the first, locally it is bad as a general lymphoid hypertrophy will occur; in the second, it is better, if there are no nasal abnormalities; in the third, it is excellent, and in the fourth, uncertain.

So far as the symptoms attributable to the focus of infection are concerned, these appear to lessen with the removal of the infected lymphoid tissue. Poor results without improvement or even worse symptoms will follow if the remaining lymphoid tissue becomes hypertrophied. This is the reason for the failure of tonsillectomy to cure generalized symptoms in so many patients. Again, after this operation the remaining lymphoid tissue may cause local inflammation with compensatory hypertrophy.

The symptoms of nasal sinusitis are often insignificant, until following tonsillectomy the remaining lymphoid tissue becomes infected, following which

there may be a secondary infection of the antrum or ethmoid. The same is true of many infections of the middle ear, which would not have developed but for secondary pharyngeal lymphoid hypertrophy and infection.

MASTOIDITIS IN INFANTS. Presented by DR. HARRY W. LYMAN, St. Louis.

Autopsies performed on infants dying of a symptom complex characterized by loss of weight, dehydration, vomiting, diarrhea and anhydremia have frequently shown pus in the middle ear and mastoid. This condition is often unrecognized during life and at a time when immediate operation might have saved life, the high postoperative mortality being attributable to late operative interference. For successful management of these cases there must be the most intimate cooperation between the otologist and pediatrician, since the recognition of the ear as the underlying focus of infection often depends on symptoms which ordinarily would not point to this organ. In any infant presenting a history of failure to gain, vomiting, diarrhea, fever and dehydration, the ears should be immediately examined. The drum should be incised at the least suspicion of infection in the middle ear; if general conditions do not improve, the mastoid antrum should be drained postaurally under local anesthesia. The appearance of the drum may not give any clue to the true nature of the condition of the middle ear other than a slight change in color or translucence, but the least sagging or edema of the posterior-superior angle of the drum or wall of the adjacent canal is a definite indication of involvement of the mastoid, and should require immediate operation. The operation should be preceded by preliminary injections of morphine or codeine, and the field should be prepared with picric acid in alcohol. Procaine hydrochloride 0.5 per cent is infiltrated into the skin and under the periosteum, and the supra-meatal triangle, beneath which lies the mastoid antrum, is exposed. This is uncovered, a rubber or gauze drain inserted, and the wound left unsutured. Dressings are done daily.

All other possible foci of infection must be excluded before any operation is performed, and other simpler methods of treatment must be given a thorough trial. The operative wounds heal in from two to fourteen weeks, delay being due at times to coexisting infection of the upper respiratory tract. The cases are frequently bilateral, the antrums containing either frank pus or thick, ropy secretion. Cultures show a predominance of *Streptococcus haemolyticus.*

DISCUSSION

DR. L. W. DEAN, Iowa City: Operation on the mastoid should be withheld until it is known whether an incision of the drum will bring about an improvement in the symptoms. Any sinus infection in the ethmoid or antrum may be acting as a focus and the patient must also be treated for this condition.

DR. LYMAN: This condition occurs most often in poorly nourished infants whose prenatal care has not been of the best. Besides operation, other valuable adjuncts are transfusion and proper regulation of diet.

FURTHER DATA ON THE DISPLACEMENT METHOD IN SINUSES: Presented by DR. ARTHUR W. PROETZ, St. Louis.

Displacement irrigation, a simple method of introducing fluids into the sphenoid and posterior ethmoid sinuses, was introduced by the author a year ago. The present paper describes experiences with the method, in treatment and in introduction of iodized oil 40 per cent for diagnosis.

METHOD

1. The patient is placed in the supine position, with his head projecting beyond the top of the treatment chair or table. The occipito-atloid joint is extended until the tip of the chin and the external auditory meati are in the

same vertical plane. This renders the sphenoid sinus, with its ostium upturned, the most dependent structure in the nasal chamber.

2. The fluid to be introduced is now allowed to flow into the nostrils from a syringe and comes to rest in this pocket, submerging the ostia of the posterior sinuses.

3. Gentle suction (not more than 3 pounds) is now applied intermittently to one nostril, the other being closed, the palate and tongue being held in the "K" position to seal the pharynx. When the suction is first applied, a bubble of air escapes from the sinus through its upturned ostium. On releasing the suction, this air is replaced by a drop of the overlying fluid. The process is repeated until the sinus is full; about a dozen alternations usually suffice to accomplish this.

4. The patient is returned to the erect position, and the fluid remains in the sinus for an indefinite period (from eight hours to several days).

TREATMENT

The mere dilution of the retained secretions and the clearing of the ostia have resulted in great improvement in many cases. The membrane has been enabled to rid itself of the infection without further treatment. The treatments are given at intervals of from three to eight days, depending on the amount and character of the discharge in the individual case.

DIAGNOSIS

Iodized oils may be employed to determine the distribution of the fluids in the nose, by means of the roentgen ray.

It will be readily seen that thickened and polypoid membrane within a cell may be detected by discrepancies between the shadow of the oil and the shadow of the bone which they occasion.

Displacement irrigation will obviously not relieve those patients with sinus disease in whom permanent changes have occurred in membrane, periosteum or bone. The treatment of these patients is essentially surgical, but it should eradicate infections which have passed the acute stage and which, due to embarrassment of drainage and ventilation, will in time produce such changes.

FRONTAL SINUSITIS. Presented by DR. AUSTIN G. MORRIS, Rochester, N. Y.

In chronic frontal sinus disease surgical intervention is needed which will give good results without deformity. As the intranasal operation often fails, the radical procedure must be adopted and has been carried out by the author as follows: A curved incision is made below the brow through the periosteum which is stripped back only along the lower margin. The oblique pulley is detached and the sinus opened above the lachrymal groove. The floor is completely removed, exposing the cavity of the sinus, so that the entire lining of the mucous membrane can be removed. Through this same exposure both the ethmoid and sphenoid sinuses can be reached. A rubber drainage tube is passed from the sinus down into the nose, the wound being closed with horsehair and stay sutures of silkworm gut. The tube is removed in from seven to nine days.

DISCUSSION

DR. H. P. MOSHER, Boston: This approach is chiefly suitable for a small sinus. The best approach is directly through the lacrimal bone. I do not favor the use of the rubber drainage tube, as it tends toward the production of granulations which defeat the end in view. Osteomyelitis of the frontal bone may be caused by removal of the front wall of the sinus.

DR. FRANK SPENCER, Boulder, Colo.: The intranasal operation should always be tried first. The external operation is indicated when it is desirable

to get a good view of the interior of the sinus, when it is necessary to remove as much mucosa as possible and when a large opening into the nose is essential.

Dr. William Mithoefer, Cincinnati: Signs pointing to disease of the frontal sinus may in reality at times originate in the ethmoid cells. Simple anatomic variations, and not frontal disease or migraine, may cause headache.

Correction of Pronounced Types of Saddle Nose by Mixed Implants. Presented by Dr. Lee Cohen, Baltimore.

Certain types of saddle nose, often thought to be due to syphilis may in reality be due to early injuries of childhood, the deformity being accentuated by subsequent underdevelopment of the bony portions. Syphilis, of course, must be excluded or if present, the patient must be treated, before any surgical procedures are undertaken. The inside of the nose must be as clean as possible and the patients' general condition must be at its maximum.

The ideal graft is a combined one, consisting of both bone and cartilage. This is best secured by using the seventh or eighth rib, with a proportion of two-thirds bone and one-third cartilage. Firm union will result without absorption and good cosmetic results can be secured. The graft can be removed subperiosteally, injury to the pleura thus being avoided. Grafts of foreign bodies such as ivory, celluloid and other inorganic substances, have not been satisfactory; while tibial grafts are open to the objection of a possible subsequent fracture.

DISCUSSION

Dr. Samuel Iglauer, Cincinnati: Implants of bone will usually be absorbed unless the stress and strain of performing some work is brought to bear on them. A graft taken from the spine of the scapula has proved satisfactory in some instances.

Dr. H. L. Pollack, Chicago: We have been using grafts of ivory with good results. It is easy to sterilize and requires only a single operation instead of the double one in removal of the rib.

Dr. E. B. Gill, Roanoke, Va.: In investigating the question of the absorption of cartilage I have placed a small piece of cartilage under the skin, and after observing it for three years, have removed it entirely unabsorbed.

Epistaxis with Sinusitis. Presented by Dr. James W. Babcock, New York.

Profuse epistaxis is sometimes encountered in elderly people which occurs suddenly, without any visible bleeding point and which after intermittent spontaneous cessation is prone to recur without warning. Investigation has shown that this syndrome may be associated with an otherwise symptomless maxillary sinusitis within which is the occult bleeding point. In such cases intranasal drainage or the sinus has led to permanent cessation of the bleeding.

Otitis Media and Swimming. Presented by Dr. Frederick E. Hasty, Nashville, Tenn.

Since 1918, otolaryngologists have been called on annually to care for a greater number of people who have developed infections in the middle ear and upper respiratory tract following swimming, and it has been customary to lay direct blame on the swimming pools for these complications. There has not been, however, an agreement of opinion as to how this infection is established. Capable men have argued that the infection was carried into the middle ear from the upper respiratory tract by the passing of water through the already infected passageways. Perhaps an equal number of capable men have argued that the infection in the middle ear was due primarily and directly to the bacteria in swimming water.

Chlorine of one form or another and copper sulphate are used in a great many pools. The violet ray has been used with considerable benefit. Heat has been employed in the circulating water system in such a way as to reduce considerably the total count. These measures are all worth while and should be used conscientiously, but it is likely that such measures would have but little effect on many of the bacteria that are commonly found on the mucous membrane of human beings. This work has been beneficial in many respects, but the results have not been satisfactory in the way of controlling infections in the middle ear and in the upper respiratory tract. For instance, people have developed complications as a result of swimming in water of unusually low bacterial count.

Known bacteria were injected into the middle ears of guinea-pigs. Otitis media in all its stages and phases promptly developed. Then water was collected from swimming pools in sterile bottles. These specimens were always collected after there had been considerable swimming in the pools and were obtained from the surface water nearest to the edge of the pool and opposite the diving board. This was immediately transferred to the laboratory, and, except for the possible contamination of piercing the ear with a small needle, was injected under aseptic conditions into the middle ear of the guinea-pig. One ear each of the three guinea-pigs was injected at each test, and one or more specimens were taken from eight different pools. Without exception, every pig developed an otitis media within twenty-four hours. As a control, water from some of these swimming pools was sterilized by boiling and then injected into the ears. This produced an inflammation of the ear drum that subsided as promptly as a tubotympanic condition in man, but did not reach the stage of a bulging drum. A further control was made by simply piercing the ear drum with the needle that had been routinely used in making these injections. This produced a slight congestion adjacent to the injury, all of which promptly subsided.

The infection in these pigs lasted from twelve to eighteen days, and on the average, the ear drum was left in a similar condition to that found in the resolving ear of man. The majority of pigs regained their weight after a few weeks. The bacterial observations in this work have not been all that one might desire. Indeed they cannot be. First of all it should be remembered that the guinea-pig possesses a peculiar resistance to many bacteria. On the other hand, it is well known that the guinea-pig is susceptible to certain organisms, and, no doubt, like human beings, more susceptible to certain strains of a given organism. A number of pigs were killed. The capsule of the middle ear was removed. All the ears were found to be in a definite stage of inflammation and there could be no question about the presence of a definite infective process. This was more marked in some than others. Cultures were made from these ears and numerous types of organisms were grown from plates of blood agar.

From the standpoint of otolaryngology, the one most important feature of the water test is the particular type of bacteria. It is easy enough to conceive of snow water, water from artesian wells or any other pure water that carries a low bacterial count which represents almost wholly a pollution from persons suffering from an acute cold, a streptococcic throat and other conditions. As already stated, the determination of the bacterial content of water to the finish is almost impossible and is surely impractical as a routine procedure in the light of present knowledge of bacteriologic investigation.

SUPPURATIVE LABYRINTHITIS. Presented by DR. GEORGE W. MACKENZIE, Philadelphia.

Suppurative labyrinthitis may follow and complicate either an acute or chronic suppuration of the middle ear, usually the latter. If the former, there may be no aural discharge, and the drum may look so sufficiently normal as to mask completely the seriousness of the complication. An outstanding

symptom of the labyrinthine condition is complete unilateral deafness of relatively sudden onset. This is best tested by the use of a noise apparatus in the good ear and a speaking tube in the affected ear. If words that are shouted are not heard by the affected ear, labyrinthine involvement is certain, provided the deafness has occurred suddenly.

The next symptom of moment is vertigo, likewise of sudden onset. It is severe in character, lasts longer than in purely irritative lesions and gradually diminishes as the patient aquires a tolerance for it. There is falling toward the side of the lesion.

Spontaneous mixed nystagmus is present, directed away from the side of the lesion, and decreasing in severity as time passes. Its relation to the affected labyrinth can be accurately brought out by turning tests whereby the after-nystagmus induced by stimulation of both the normal and involved labyrinths can be estimated and measured.

Finally, the function of the involved labyrinth can be still more definitely investigated by the use of the caloric and galvanic tests, both of which will show an absence of reaction in the suppurative side. The fistula test will give a negative result, as would be expected in a functionless labyrinth.

Complete deafness and loss of all response to caloric stimulation are the cardinal signs of labyrinthine suppuration. In addition severe headache appears to be a less recognized but frequent symptom.

Once the condition is diagnosed an operation should be performed which combines radical exenteration of the mastoid and drainage of the labyrinth. The former alone will not suffice and may lead to a fatal termination. A certain percentage of the patients will develop a postoperative facial paralysis which cannot be avoided. Following an operation for true suppurative labyrinthitis, there will not be an increase in vertigo or nystagmus. Healing usually takes place with reasonable promptness with cessation of aural discharge.

DISCUSSION

Dr. W. H. Sears, Huntington, Pa.: About 1 per cent of all cases of suppuration of the middle ear are complicated by some form of labyrinthine suppuration. The form that I have most commonly seen is a circumscribed type following chronic infection of the middle ear and demonstrated by an erosion in the horizontal semicircular canal uncovered at the time of a radical operation on the mastoid. For this condition, further operation is not usually needed.

Another form of labyrinthitis is the so-called induced form which follows a radical operation on the mastoid, due either to trauma or operative reaction, usually clearing up in a short time, but occasionally going on to the production of a completely dead labyrinth. For this reason it is advisable to test the labyrinthine function of every ear before performing the radical operation on the mastoid.

Labyrinthine complications in acute otitis media are particularly liable to extend to the meninges and hence the extent of the damage must be determined early. The degree of the loss of hearing is the most accurate criterion, and as long as any hearing remains spontaneous healing may take place.

The Weber test is also of use in this connection. If there is a change during the disease in the lateralization, it is an indication that cochlear structures are undergoing damage and suppurative labyrinthitis must be suspected.

Dr. Lewis Fisher, Philadelphia: Labyrinthitis, in our experience, is a rare complication of chronic otitis media, and we always try to exclude any possible intracranial complication before making this diagnosis. In this respect the caloric test is of the greatest value if carried out bilaterally. The diagnostic tests mentioned by the author would seem to be conclusive, and yet they may be misinterpreted and lead to false conclusions.

Dr. William B. Chamberlin, Cleveland: I have seen a case of a woman who suddenly thrust a hairpin through her drum and oval window. Sudden pain, dizziness and vomiting nystagmus to the sound side and complete deafness followed. Subsequently she recovered almost completely, except for some tinnitus. She did not receive any treatment except rest, and operative intervention might easily have made the condition worse.

Dr. Leon White, Boston: We rarely see patients who require operation, and we consider labyrinthine symptoms due to a serious exudation. Will not patients with true suppurative labyrinthitis often recover? If not, how can we explain the frequent dead labyrinths which are discovered by caloric tests preliminary to a radical operation on the mastoid.

Dr. Mackenzie: Not every case of loss of hearing and labyrinthine function mean suppuration since chronic plastic inflammation can lead to the same result and the patient may recover spontaneously, but a patient with pus in the labyrinth is always in danger of intracranial extension. If these patients are to be operated on, halfway measures will not suffice and will only lead to trouble. Nothing short of the radical operation on the mastoid combined with labyrinthine drainage will suffice.

Obstructive Laryngeal Dyspnea. Presented by Dr. Gabriel Tucker, Philadelphia.

Acute dyspnea due to some form of obstruction of the larynx, as distinguished from some intrapulmonary cause, requires immediate surgical treatment for its relief. This may consist of the removal of some cause such as a foreign body, or the relief of external pressure due to a lesion such as retropharyngeal abscess. Second, the airway may be restored by insertion of an intubation tube, and third, it may be short-circuited by means of tracheotomy.

In any acute laryngeal obstruction any attempt to treat the patient for resultant restlessness by morphine or other sedatives is not only useless but harmful, since it tends to deprive the patient of the use of his much needed accessory muscles or respiration, and inhibits useful coughing. This applies equally to obstruction due to extralaryngeal as well as to intralaryngeal conditions. The diagnosis must be made by direct and indirect inspection of the larynx, the general physical signs, the roentgen-ray and bacteriologic examinations.

The outstanding signs and symptoms of obstructive laryngeal dyspnea are inspiratory retraction of the supraclavicular and suprasternal, epigastric and intercostal spaces. Stridor, wheezing, restlessness and cyanosis soon follow, the latter as a late sign of cardiac failure.

The best and surest treatment for relief of urgent dyspnea of this type is tracheotomy, performed under local anesthesia, and below the first tracheal ring.

An illustrative case is that of a boy, aged 2½ years, on whom intubation was performed for eight weeks before following diphtheria. Following extubation, dyspnea gradually became more severe and fever appeared. On admission to the hospital, he was comfortable as long as he was quiet, but any exertion produced all the respiratory embarrassment with its typical signs. Tracheotomy was performed with marked relief and with the release of much mucopurulent secretion from the trachea. A later laryngeal examination revealed an inflammatory subglottic stenosis. Subsequent direct laryngeal bouginage brought the lumen up to size 24 French. The child had an excellent voice and easily tolerated complete corking of the cannula.

DISCUSSION

Dr. A. W. Proetz, St. Louis: Do not wait till the patient is in moribund before performing tracheotomy. The earlier the operation is performed once the indicative signs are present, the better for the patient and the easier for the operator.

Dr. E. B. Gill, Roanoke, Va.: Tracheotomy is often facilitated if performed after the preliminary introduction of the bronchoscope, as this assures a more clearly delinated trachea and an airway free from blood, and prevents of trauma to the posterior tracheal wall.

Dr. J. B. Green, Ashville, N. C.: I should like to advocate earlier performance of tracheotomy in cases of tuberculosis of the larynx. While not curative, the operation affords patients a great deal of comfort and often retards the pulmonary process. The injection of a little cocaine into the trachea preliminary to insertion of the tube helps greatly to prevent excessive coughing following its introduction.

Dr. W. B. Chamberlin, Cleveland: Never wait for cyanosis in these patients, since this sign marks the point of impending exhaustion. Proper maintenance of the position of the head during operation is of great importance, and is a duty which must be assigned to a competent assistant. Care must be taken to prevent excessive extension of the head, since sudden laryngeal edema has been known to result.

Great patience is needed in the process of decannulation, since children often become panic stricken when the tube is removed even though there is no longer any laryngeal obstruction. Gradual reeducation to normal laryngeal breathing is the best method of handling the problem.

Dr. Bert R. Shirley, Detroit: In many cases of sudden edema of the glottis, I think that intubation is a useful and satisfactory procedure. This is particularly true in postbronchoscopic, laryngeal edema, following which intubation for a few days works splendidly.

Dr. Chamberlin: Intubation is futile at times in cases in which there occurs a prolapse of the laryngeal tissues over the opening of the tube. In such an instance, tracheotomy would be preferable.

The Limitation of Functional Tests in the Differential Diagnosis of Deafness. Presented by Dr. Edmund P. Fowler, New York.

Functional hearing tests are relied on chiefly to differentiate obstructive from nervous conditions of the auditory apparatus. Among these the Weber, Rinne, Schwabach and Gelle tests, though at times trustworthy in certain cases, cannot be universally applied without misleading conclusions.

Accoustically, there are three factors or attributes which control the progress of variations in sound through any conducting or transmitting system such as that of the ear. These are: (1) weight or inertia, (2) elasticity and (3) friction. These three may act singly or together in various ways, and although different parts of the conducting mechanism may transmit sound by more than one mode or direction of motion, the single mode is common to normal ears; if it is assumed that vibrations of different parts of the mechanism take place as usually described, it is comparatively simple to predict, at least qualitatively, the effect of any simple type of lesion on the audiogram.

Experimentally, the effect of weight or inertia has been demonstrated by gluing a shot of 0.085 mg. to the umbo. Audiograms in the horizontal and vertical planes were made before and after this experiment, and showed that the lower tones are little affected if at all while the higher tones are definitely lowered. With the shot in a different place, the reverse results were obtained.

DISCUSSION

Dr. John B. Rae, New York: Limitations of functional examination must be considered in relation to: (1) the purpose of the examination, (2) the method of examination and (3) the deductions to be drawn from the complete test.

Among the general limitations, the personal equation of both patient and examiner must be included. The latter may be corrected and void, but the

former manifested by both the patient who is really hard of hearing and the malingerer constitutes a more difficult problem, especially medicolegally.

1. The purpose of the examination is to determine the status of the patient's hearing and to facilitate a diagnosis. Although any variety and combination of tests may serve for future comparison, only those concerned with the voice interest the patient. If these tests are not always carried out by the same examiner, confusion follows; hence, the great value of the new phonographic test which standardizes the tests so accurately. Diagnostically, functional tests are only a part of the picture, which must include a good history and a general physical examination. Broadly speaking, they aid in distinguishing between a lesion in the conducting apparatus from one in the receiving mechanism.

2. If the voice and acumeter tests and the determination of absolute bone conduction are exluded, the purpose of the remaining tests is to show the hearing at different frequencies from the lower to the higher portion of the scale. For this either a set of graded forks is usually used or the more modern audiometer. The forks are purely qualitative while the audiometer adds a quantitative factor, at a given frequency. One trouble with both methods is the increasing gap in frequencies as the upper end of the scale is approached, due to the gradation by octaves. Progression by a fixed constant increase might prove more useful. One fallacy of the audiometer is its inability to produce an audible amplification at a given frequency which would still be within the range of serviceable hearing, and producible by a fork of the same rate of vibration.

3. To the deduction, however subject to error made from the results of tests with the forks and audiometer must be added the results of absolute bone conduction, together with those of the Rinne, Weber and Gellé tests. All the results are of value only as they serve to facilitate conclusions as to accurate diagnosis and prognosis.

Dr. R. L. Wegel, New York: Too technical.

Dr. Robert Sonnenschein, Chicago: Tests with tuning forks may give fallacious results at times and great care must be used in interpretation of them. The stem of the fork, moreover, has a different rate of duration of vibration than the prongs. This can be obviated by setting the stem into a tube which does not act as a resonator, whereby the stem and the works will vibrate for the same length of time.

Dr. George McKenzie, Philadelphia: With one normal ear and one deaf ear bone conduction is the result of the combined hearing of the two ears, more, of course, coming from the normal ear. Complete unilateral bone conduction is usually nonexistent.

Dr. E. P. Fowler: I do not think it is necessary to have the intervals in the forks and in the audiometer too close together. Tone islands are not particularly important, since the diagnosis must be made from the general trend of the loss of hearing. Unilateral bone conduction would be useful, but except in absolute nerve deafness it is impossible. Ultimately the forks must be used for a comparison of hearing by bone and by air.

Report of the Committee of the American Federation for the Hard of Hearing. Presented by Dr. George Berry, Worcester, Mass.

The work of investigating the hearing of large numbers of school children may be divided into three groups: (1) the mechanical testing of the hearing, (2) the general medical care of the patients and (3) the measures for educational relief.

The first of these involves four problems; accuracy, speed (obtained by group testing), cooperation of the children and, lastly apparatus sufficiently rugged to withstand such hard work.

The second problem deals with the handling of the deaf patient. The younger the child the harder this is. Advantageous conditions for work must be secured, such as a quiet room, front seats with special help from the teacher. Each deaf child should be examined by an otologist for general otolaryngologic pathologic conditions, a record of which is kept and filed. Notes are sent to the teacher with advice as to classes in speech and other instruction, also a note to the parents. Hearing tests should be repeated yearly. Attention to the teeth, throat or nose such as may be needed is carried out by a district nurse.

With regard to education, it has been found that from 12 to 15 per cent loss in hearing requires special training and help. Much time is lost and money wasted by deaf children who have to repeat grades. Only by careful attention to these deaf children can satisfactory progress be made.

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